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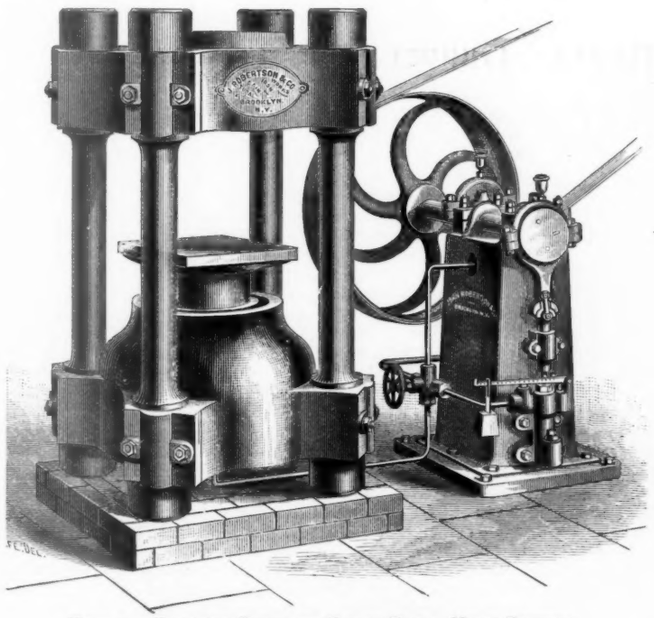
Carbon—Its Uses, and How Manufactured.

No more interesting and useful substance than carbon has ever been discovered among all the elements which have contributed to the advancement of science and art.

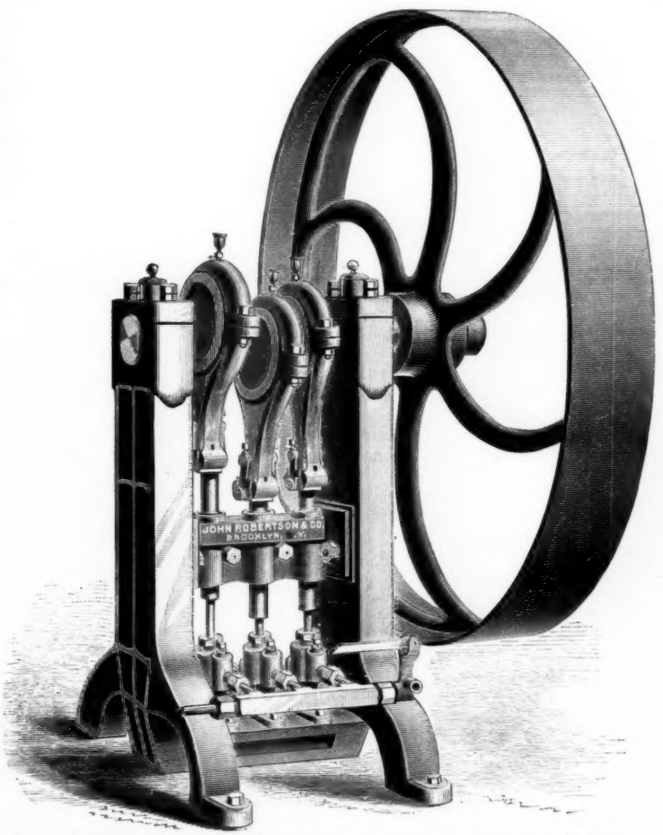
We will first briefly explain the process necessary to the manufacture of carbons for electric lighting, as they comprise the principal feature of expense in all systems now in use.

The Hydraulic Presses used in the manufacture of carbons for the electric light companies, which we illustrate to-day, are designed and built by John Robertson & Company of Brooklyn, N. Y. The more durable and better the carbon, the steadier and more efficient the electric light will be, and a machine which will greatly increase the solidity of the carbons directly tends to improve the light.

It seems to be acknowledged that this press has been a decided success in improving the carbons.



HYDRAULIC PRESS AND PUMPS FOR CARBON POINTS, MOLDS PRESSING.



TRIPLE ECCENTRIC HYDRAULIC PUMP, USED FOR WORKING THE HORIZONTAL PRESSES.

Carbon points are pressed in two different ways. One is by putting the carbon material into moulds in two halves the proper shape and size, then putting the moulds into an ordinary hydraulic press and subjecting the same to a pressure of about 400 tons. The engraving shown represents one style of hydraulic press, and used extensively by moulded carbon manufacturers for pressing carbons preparatory to their being baked or burned. The other method of pressing carbons is by forcing the material through a die in long lengths. The engraving shows a double-acting hydraulic press, with a cylinder attached for holding the carbon; the material is pressed into cakes of five inches diameter and five inches long. These cakes having been subjected to the same amount of pressure as is required for pressing through the die, those cakes are then put into the material cylinder, which is heated with steam, and a pressure of 200 tons applied to the carbon by aid of the triple eccentric hydraulic pumps (shown in engraving); these pumps are capable of working two horizontal presses, and with an accumulator attached can be used for working four presses. The carbons pressed through a die are always of a uniform size, and as they pass through the die are cut off to suitable lengths and carried away to the drying rooms. This class of machinery is used by nearly all the carbon point manufacturers throughout the United States.

The main cylinder of the press is copper-lined with double-acting water ram. This ram is kept in line by a heavy gland, which in turn is guided by the heavy brace rods that hold the water and carbon cylinders together. Around the carbon cylinder there is a steam jacket for the purpose of heating the mixture to the proper temperature before it is pressed. When this point is reached the tension is applied and the carbons are forced through a die at the end of the cylinder. The fit of the ram is so close that it is necessary to force it back as well as forward, and this is accomplished by applying a reversed pressure which greatly accelerates the work.

The material used for making the carbons is the purest carbonaceous substance that can be found, and the finest coke or the lining of gas retorts is generally selected. These materials are ground to an impalpable powder, and mixed with an adhesive substance before being put in the cylinder.

In explaining the various uses of carbon, and the many forms in which it exists, Prof. Tanner, in a recent lecture, said that "carbon is one of the most abundant materials in nature, forming nearly half of the vegetable kingdom, and entering largely into the composition of all animal matter. Then it exists locked up in combination in limestone, coral and other carbonates, vast beds of these substances occurring in numerous sections of the world. And again, we meet with this useful article stored away in immense layers in the interior of the earth as mineral coal, a material hidden away for the comfort of coming man, millions of years ago, during that geological period of our earliest history, classed as the carboniferous age. Carbon is found in two distinct crystallized forms or modifications, diamond, the clearest and most brilliant of all substances, and as graphite, this black and dirty material."

The lecturer then briefly reviewed some of the most common forms, commencing with the purest, the diamond. On account of its great brilliancy and remarkable hardness, the diamond has ever been valued as a precious stone. Up to the year 1777 this gem was supposed to be a kind of rock crystal; but, during that year, by means of the blow pipe, it was shown that it did not contain silica, and then it was looked upon as a fossil resin, something of the order of amber. That diamond was combustible seems to have been known at an early age, and, strange to say, there are some very remarkable statements just the reverse, *e. g.*: One authority states that his father, at the command of a prince, heated diamonds in a gold-melting furnace for about thirty weeks with no perceptible change. Newton, who seemed to hesitate at no problem, and at the same time solved whatever he undertook, first gave convincing arguments to prove the combustibility of this precious substance; his proof being based on the high refractive power of diamond, a property peculiar to the class of all assimilating bodies. This theoretical proof was afterwards experimentally proved by placing the diamond in the focus of a large burning lens, when it entirely disappeared.

Various observers experimented with it, until finally the product of the combustion was proven to be carbonic acid, the same as results from the burning of charcoal; hence the truth was finally reached that diamond is nothing but carbon in its purest form. This royal stone was brought to Europe from the East, but the mines that were once so famous are now entirely exhausted. Of late years the diamond fields of Brazil and the Cape are the most noted, but this precious

material is also found in Borneo, New South Wales, the Ural, California, Georgia and other localities. Although this beautiful and valuable work of Nature's laboratory is nothing but pure carbon, we know absolutely nothing definite concerning its origin, and while numberless attempts have been made by competent and earnest workers to produce it artificially, it is extremely doubtful if this has ever been accomplished, though now and then it is announced with a great flourish that this interesting problem has been solved.

To mention the names of the greatest diamonds of the world, or recite the histories, bloodshed and misery that the various owners of them experienced is needless, as every one must be familiar with them.

A very large business is done now in artificial or paste diamonds. They are made of a glass of special make as to hardness and refraction, but on much handling become scratched so as to lose much of the beautiful play of colors, so remarkable in the genuine, and which this never loses. Owing to the crystalline forms of the pure article, it admits of being split into thin pieces, and these sheets are taken and used as a veneering on the facets of the glass body, giving an imitation that does not lose its luster. Then imperfect stones are stuck together so as to produce large ones, and this work of patching up the diamond into the spurious article is done in such a skillful manner as often to defy the most acute experts.

So much time has been given to carbon in its purest form, it will only be possible to mention the other forms before taking up the compounds and a series of experiments. The other crystalline form is the substance graphite, or familiarly known as black lead, a name given to it on account of its producing a mark similar to lead on paper, and was supposed to contain lead. Graphite is the substance used in pencils, and is the basis of all stove polishes. In the arts this material is of great value, because it will stand the strong heat of metal furnaces, and is much used for crucibles where an intense heat is required, as in the casting of brass and in steel works. The amorphous forms of this wonderful element you are all familiar with under the names of gas carbon; the deposit on the iron retorts in which bituminous coal is heated to produce illuminating gas; anthracite and bituminous coal, coke, charcoal and lampblack. Charcoal, besides the ordinary uses of everyday life, is much used as a disinfectant, owing to its great absorptive power for gases, then it has the valuable quality of removing coloring matter from organic solutions, and in the form of animal charcoal is used in very large quantities by sugar refiners to remove coloring matter from brown sugar in order to produce the beautiful white sugar we now see on our tables. This peculiar property is thought to be due to the capillary spaces permeating charcoal, a cubic inch of it being so crowded with these minute pores that it is estimated to give 100 feet (square) surface.

Starting with this precious gem, the diamond, the hardest known substance, the type of all that is pure and beautiful, we see this wonderful substance passing downward in hardness and beauty, finally to sink to the level of this black soot which darkens our atmosphere and soils our persons and all we have that is beautiful. What an immense range of properties and usefulness it covers! As lampblack it sometimes burns spontaneous; as graphite it resists the action of the smelting furnace; in diamond it is a non-conductor of electricity; as gas carbon it forms one of the best conductors; in one form the person is adorned, in another our books and papers are printed with it; the electrician takes and uses it for the promotion of our comfort, while as charcoal crayon the artist handles it; as coal and coke it gives us light, transports great distances at a rapid speed, smelts our metals, cooks food, warms the body, and in numberless ways adds to the comfort of mankind. To man this is the most useful of all the elements, and adds more to his comfort in this temporary home than any substance that finite mind can conceive of.

The Older Electricity.

PROF. TYNDALL ON ITS PHENOMENA AND INVESTIGATORS—INTERESTING EXPERIMENTS.

Prof. Tyndall is delivering at the Royal Institution a course of lectures on "The Older Electricity—Its Phenomena and Investigators." The lectures are illustrated by a number of experiments. Historic memoranda formed the staple of the introductory discourse. The audience were reminded that all the ancients knew of electricity was the one fact of the action of amber, which the Greeks called *electron*, when rubbed upon light bodies. It had this property in common with jet, and in a far fainter degree with heated tourmaline. Thales (B. C. 580) thought a kind of soul dwelt in amber, and three centuries afterward Theophrastus wrote on the subject. Dove cited also the remarkable saying of a Chinese philosopher, named Kuopho, in the beginning of the fourth Christian century, "The magnet attracts iron as amber attracts small bodies." But it was first at the hands of Dr. Gilbert, Queen Elizabeth's physician, that the subject was expanded. "The power," said that father of modern electrical science, "when rubbed to attract light bodies of all kinds, such as metal, wood, leaves, even water and oil, is not peculiar to amber. It belongs to a whole class of very different substances, such as glass, sulphur, sealing-wax, and all resins, rock crystal, and all precious stones, alum, and rock salt, as may be proved when the air in winter is cold and clear." The essential point, the lecturer said, before verifying experimentally Gilbert's new list of attracting substances, was the dryness of the air. Boyle (1670) showed the reciprocity of attraction; observed the new flash of a rubbed diamond; obtained attraction in vacuo, and made other experiments. On his mind first dawned a kind of electric theory, in his idea that light bodies were drawn by a glutinous effluvium toward the amber, etc. Otto von Guericke mounted a globe of sulphur, and turning it by means of a handle, his hand acting as a rubber, struck out in a dark place the first spark of electric light from this primitive electric machine. He, too, was the first to notice that a light body, after touching his ball of sulphur, was sometimes repelled. Dr. Wall (1703-9), whose chief aim was to get light and fire, most suggestively compared the electric flash and crackle with thunder and lightning. Newton covered a metallic ring with a plate of glass, and rubbing the lid with his gown, the imprisoned particles "leaped nimbly about as if carried by a whirlwind." His experiment was repeated in the course of the lecture by Prof. Tyndall, amid loud plaudits, with perfect success. Hawksbee (1705) greatly improved the electric machine, and experimented most successfully on the production of light in rarefied air. The luminous barometer, however, had already been discovered in 1675, by Picard. During a dark night he had a barometer carried a long distance, and observed how, as the mercurial column oscillated, light flashed forth in the vacuum above it.

But he mistook its nature when he ascribed the phenomenon to "mercurial phosphorus." His experiment was one of the dozen illustrative of the lecture. Gray's most fruitful researches (from 1728) were next recounted. He reached the important discovery of conduction and insulation, and made many experiments on induction, considerably advancing the knowledge of this point. By bringing a rubbed glass tube near one end of a wooden pole 27 feet long, he produced attraction at the other end. He suspended boys by silk strings, and electrified them as he had electrified his pole. He showed also that the electric attraction extends to liquids. The day before his death Gray communicated his latest discoveries to Dr. Mortimer, the secretary of the Royal Society, in whose "Transactions" they were printed. The passage in which Priestly styles him "this great electrician," was quoted by the lecturer. Among the French philosophers who took up the subject at this time, DuFay (1733) and Dr. Desaguliers (1739) were singled for their many important experiments and their significant results. About the same epoch (1742) the Germans entered the field. Boze, or, according to others, Hansen, reverted to the use of Hawksbee's glass globe. To this he added a "prime conductor," held at first by a man standing upon cakes of resin. He afterward suspended the conductor by silk. In Boze's experiments threads played the part of the comb of points in modern machines. Winckler also used a glass globe, substituting a cushion, instead of the hand, for a rubber. Gordon, of Erfurth, a Scotch Benedictine monk, displaced the glass globe by a glass cylinder, like that still used from time to time in the Royal Institute.

In his second lecture Prof. Tyndall begun by reminding his audience of the immense impression produced by the ignition of inflammable substances by the electric spark. It was at the opening of the Berlin Academy of Sciences, in 1774, and in the presence of Frederick the Great, that Dr. Ludolf ignited sulphuric ether by a spark from the sword-point of an officer present at the ceremony. The lecturer varied the experiment by lighting an Argand gas burner by means of an electric current. Next, causing himself to be electrified, and standing on a footstool with glass legs, he lit it with his finger. The effect was even more striking when the igniting current passed through a piece of ice in his hand. Another experiment verified Du Tour's discovery of the extraordinary power of flame in discharging electrical currents. The distinction long dominant between what Dr. Gilbert called electrics and non-electrics, the former deemed capable of electrification, the latter not, was discussed at large and illustrated by several remarkable experiments Thus amber and the various spars, glasses, and resin were classed as electrics, while all the metals figured as non-electric. Accordingly, a piece of metal or a carrot, which also ranked as a non-electric, would not, when rubbed, however briskly, with flannel, attract light bodies like amber. But a carrot, as the lecturer showed, when placed on a glass stand and properly rubbed, at once behaved electrically and so with metals the human body, and the other non-electrics. These we now recognized as conductors, and the electrics as insulators. Gilbert's classification led to the theory of two electricities—namely, the electricity of glass, which Du Fay termed vitreous, and that of the resins, which he termed resinous, names now superseded by positive and negative. It was surprising what a number of phenomena this theory of two electric fluids enabled us to group together and explain. Foremost among these came the phenomena of electric induction, or the decomposition of an electric fluid by the mere presence (sensibly short of contact) of an electrified body. This was illustrated in a very telling manner by the repetition, amid unusually demonstrative applause from the audience, of Stephen Gray's experiments on a soap-bubble and a hop-pole 17 feet in length.—*London Times.*

Concerning the Coming Electrical Exhibition.

Editor of Electrical Review:

In the editorial reference to the contemplated Electrical Exhibition of the Franklin Institute, which appeared in the issue of your valued REVIEW of the 3rd of April, I notice some unfavorable criticisms upon the decision of the committee on exhibitions to award no medals or premiums. Respecting this decision, I have to say, that it was the result of a careful and deliberate consideration of the subject.

Having originated the practice of holding exhibitions in this country over fifty (50) years ago, and having held since that time many exhibitions, it is not assuming too much, I think, to claim that such an experience should enable its officers to pass an intelligent judgment upon a question of this nature.

In the days when American manufactures were in their infancy, and industrial exhibitions were confined to a few of our cities, the award of medals was unquestionably an appropriate and graceful means of distinguishing and rewarding merit. Of late years, however, the multiplication of such exhibitions in many of the leading cities of the Union, at all of which the award of medals is a recognized accompaniment, has robbed the system of the special significance it once had.

With all deference to the evident sincerity of the views advanced in your editorial, I venture the statement that if an opinion were invited from the representative manufacturers, who contribute the most interesting and valuable share of the annual exhibitions, nine-tenths of them would condemn the system of awarding medals as one that had outlived its usefulness; while, if the candid opinion of the managers of the exhibitions were given, there would be a unanimous expression in favor of its abandonment, as the fruitful source of unseemly jealousies and endless dissatisfaction. For these reasons and others less important, the committee entrusted with the work of organizing the plans of the forthcoming Electrical Exhibition of the Franklin Institute, decided to depart from its time-honored custom of awarding medals, and to substitute, in lieu thereof, the plan of a thorough system of reports by a carefully chosen board of examiners, under the signatures of the examiners, and to be issued, with the official sanction of the institute, after careful investigation. The event will demonstrate whether or not this decision was a wise one.

The work of the examiners that shall be appointed will be done *free of all charge* to the exhibitors; and only in the case of special competitive tests that may be desired by exhibitors will they be called upon to pay the actual cost of such special examinations as they may wish to have made.

Respecting the general body of the rules and regulations, I may remark in conclusion, that, with the notable exception commented on in what has preceded, they are substantially the same as those which have been in force in former exhibitions held by the Franklin Institute, and which have been found to be satisfactory in operation. I have no disposition to question the correctness of your statement, that the regulations of the late Electrical Exhibition, held at Vienna, could not be improved upon. They were, undoubtedly, excellent.

For the purpose, however, of giving point to your strictures on the "innovation" determined upon by the Franklin Institute committee (*i. e.*, dispensing with the award of medals), which is the obvious intention of the allusion, the reference to the Vienna Exhibition is a singularly unfortunate one, since the managers of that exhibition influenced, doubtless, by the same reasons that were deemed sound by the Franklin Institute committee, adopted the rule of *granting no medals*, this making a precedent in Europe, which the Franklin Institute propose to make in this country.

I have before me the official catalogue of the Vienna Electrical Exposition of 1883, issued by the commission, from which I quote below the text of Article 22 of the Regulations, viz:

"Es wird Keinerlei Pramiirung durch ein Jury statt-finden.

"Wahrend der Dauer der Ausstellung wird eine technisch-wissenschaftliche commission construirt werden, um im Einvernehmen mit den betreffenden Ausstellern Electro technische Messungen und andere wissenchaftliche Untersuchungen vorzunchmen, und eventuell Zengnisse daruber auszustellen."

Which, rendered into English, would read about as follows:

"No premiums of any kind will be awarded by a jury.

"While the Exhibition is in progress, a technico-scientific commission will be constituted, to conduct, with the consent of exhibitors, electro-technical measurements, and other scientific investigations, which, shall eventually be certified and published."

Trusting that the result may demonstrate the wisdom of the committee's decision on this point, I am your obedient servant,

WM. H. WAHL,
Secretary Franklin Institute.

Philadelphia, April 5, 1884.

Recent Progress in Dynamo-Electric Machines.

By Prof. Silvanus P. Thompson.

Passing from ring-armatures, I come to another type of machine having disc armatures. The earliest machine of this type was due to the indefatigable Mr. Edison, who built up his disc of radial bars connected at the outer ends by concentric hoops, and at the inner by plates or washers. Each radial bar communicates with the one opposite to it; and the disc thus built up is rotated between the cheeks or pole-pieces of very powerful field-magnets, which very nearly meet, and which therefore yield an enormously powerful field. I cannot hear of any of these disc dynamos having yet come into practical use.

Another type of disc dynamo has been invented by Sir W. Thomson. In this case, the armature is a flat wheel, very like a flattened bicycle wheel. The radial arms or spokes of the wheel, in which the currents are induced, are all connected at their external ends to the copper rim, but at their internal ends are carefully insulated and connected each to a segment of a collector or commutator. As in Edison's disc machine, so also in this, the thin disc rotates between the poles of very powerful field-magnets, which, in the case of Sir W. Thomson's machine, are semicircular in form. Sir W. Thomson also pivots his armature with its axis vertical, and spins it like one of his gyrostats. Unfortunately, the machine has not shown itself to be in practice a success. Its construction necessitates a very high speed, else the electromotive force would be small. If the radial bars, instead of being all joined to one rim, were united by overlapping insulated rims, each one to the one next to that diametrically opposite, and a connection brought round again at the hub to the next but one from that at which the outer rim started, then, applying similar connections all round, the radii would all be connected in circuit, and a much higher electromotive force might be obtained. I am not aware that any disc so connected has yet been tried.

Some improvements have also been made in the Elphinstone-Vincent machine. The sections of the armature of this machine are wound separately in parallelogram forms, and the separate sections are then fixed upon the periphery of a papier maché cylinder which is mounted so as to rotate between powerful field-magnets and internal field-magnets whose poles reinforce the field. In the improved machines the parallelograms of wire are so arranged that the overlapping ends lie outside the ends of the polar surfaces of the field-magnets, which, therefore, can be brought very close to the surface of the rotating cylinder. Amongst other improvements, also, segments of the collector are internally cross-connected, so that only two brushes are needed instead of six as formerly. Several improvements in mechanical details have also been made.

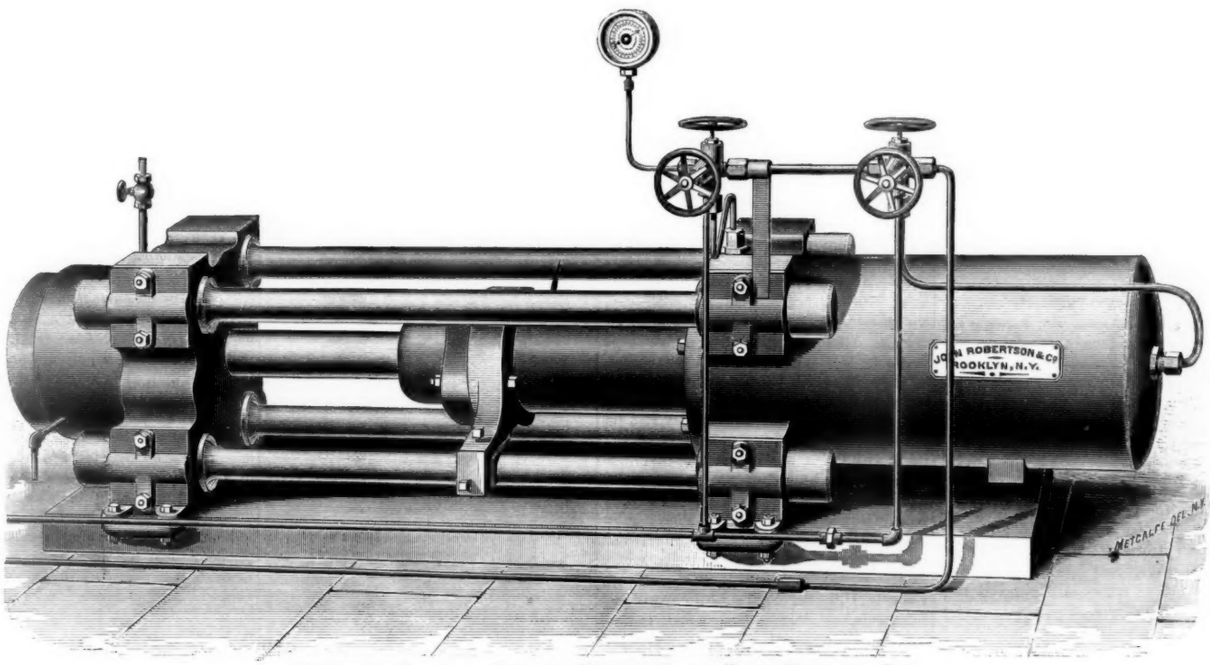
In alternate current machines something has also been done. The Ferranti-Thomson machine, which, at the date of my Cantor lectures had just made its appearance, has been considerably perfected. Externally, the machine is scarcely changed at all; the driving pulley being a little larger in proportion Internally, considerable changes have been made, and in these the hand of the experienced mechanical engineer is apparent.

A very large alternate current machine was shown at the late Electrical Exhibition at Vienna, by Messrs. Ganz, of Buda-Pesth. It was capable of furnishing light for 1,200 Swan lamps (20 candle-power each). This dynamo, which in some points resembled Gordon's well-known machine, was constructed according to the Mechwart-Zippernowsky system. The 36 bobbins of the field-magnet were set concentrically on an iron frame, and rotated within an outer circle of 36 armature bobbins. The field-magnet coils were, in fact, the fly-wheel of the high-pressure compound engine which drives the machine and its exciter. The diameter of the rotating part was 2½ metres. A salient feature of this machine is the fact that any one of the coils, either of armature or field-magnets, can be removed from the side of the machine, in case such are needed. The whole fly-wheel can, in this way, be taken down by one man in a few minutes. An electrical efficiency of 85 per cent. is claimed for this machine.

Of one other class of machines—the unipolar dynamo—I had intended to say something. It is a remarkable thing that, though to my knowledge a great deal of attention has been paid lately to machines of this type, no one has yet succeeded in designing a practical unipolar dynamo. There seems to be some hiatus in the theory of this class of machine, for the very singular fact remains that those which are designed in defiance of precautions to avoid wasteful internal eddy currents will work, though badly, and those designed with such precautions will hardly work at all.

There are two or three other new designs for machines which, at present, can hardly be called anything but curiosities. There is, for example, a design for a dynamo by Sir Charles Bright, in which the field-magnet coils and armature stand still, but in which the iron cores and the brushes rotate. There is another design by Professor G. Forbes, in which part of the field-magnets rotate. Mr. C. Lever has designed a machine on somewhat similar principles to the foregoing. I have myself essayed an alternate-current machine, in which both armature and field-magnets stand still, while laminated pole-pieces alone revolve. I hear also of a dynamo designed in the States in which there are no field magnets, only two revolving armatures.

To sum up, then, it may be observed that in every department under review, the story of the past 15 months is one of solid progress. It has been, it is true, progress of a quiet and perhaps of a commercial rather than a scientific order, yet, as I have shown you, one in which practice and theory have gone hand in hand. It is true that in some few points theory is a-head of practice, but in a still larger number practice is ahead of theory. It would be a great boon to us if our theoreticians could bring up theory to the level of practice in some of the simplest facts. We do not even know the exact law of the saturation of iron in electro-magnets, and content ourselves with formulæ, which we *know* to be incorrect. Of the laws of induction of magnetism in circuits partly consisting of iron, partly of strata of air, or of copper wire, we know very little. We want some new philosopher to do for the magnetic circuit what Dr. Ohm did for the voltaic circuit 50 years ago. There is ample room for progress yet in theory as well as in practice; and the perfection of theory means the deliverance of practice from arbitrary rules of thumb, and from the blunders of inexperience which have so retarded progress in the past. The history of the past 15 months, however, gives great encouragement for the future, because it shows how much may be done, even in the face of great commercial depression, by those whose knowledge and experience give them a deliberate faith in the future, and whose efforts are directed toward no uncertain end. A steady development toward the yet far distant goal of perfection is going on unceasingly. The progress of which I am permitted to be the chronicler to-night is progress of the good and substantial kind, that owes nothing to the excited rush of Stock Exchange speculation, and which, not having been nurtured at an unhealthy fever heat, is destined to be of permanent value.—*Ex.*



Horizontal Hydraulic Press for Pressing Carbon Points Through a Die.

An Electric Tramway Incident.

The following appeared in the *Irish Times* (Dublin) on the 22d inst.: "It is not generally known that the country people along the line of the electric railway make strange uses of the insulated rails, which is the medium of the electricity on this tramway, in connection with one of which an extraordinary and very remarkable occurrence is reported. People have no objection to touch the rail and receive a smart shock, which is, however, harmless, at least so far. On Thursday evening a ploughman, returning from work, stood upon this rail in order to mount his horse. The rail is elevated on insulators eighteen inches above the level of the tramway. As soon as the man placed his hands on the back of the animal, it received a shock, which at once brought it down, and falling against the rail it died instantly. The remarkable part is, that the current of electricity which proved fatal to the brute must have passed through the body of the man and proved harmless to him."

The American Electric Light Company, of Hartford, chose the following directors and officers on Tuesday: A. C. Dunham, T. O. Enders, Leverett Brainard, Burdett Loomis' Henry Stanley, George S. Gilman, Charles H. Owen, H. M. French, Edward H. Goff. Officers—A. C. Dunham, President; H. M. French, Vice-President; H. M. Clark, Secretary and Treasurer; F. A. French, Superintendent.

Influence of Scientific Studies.

Gen. Walker says that, while it must be conceded that force of expression and faculty in the communication of thought are best to be acquired through the philosophical, dialectical, rhetorical studies and exercises which in the main compose the curriculum of older institutions of our country, he believes it to be equally true that the faculties of clear perception, of careful discrimination, and of just generalization are developed by the study of natural history, of chemistry, of physics, as they can be through no other educational means.

The Maxim Electric Light and Power Company, of Philadelphia, have been awarded the contract for lighting the new Government buildings in that city, and the work of installing the plant is now in progress. The plant is to consist of 100 Weston arc lights, and 600 Maxim incandescent lights, which are supplied by 8 Weston dynamos driven by 2 Porter-Allen engines of 100 h. p. capacity each.

ELECTRICAL AND SCIENTIFIC

Professor Langley, London, has shown that the normal color of light is not white, but bluish.

Scientific men rarely die so rich as the late Sir William Siemens—two million dollars personalty, and realty as well.

Sioux City, Iowa, has a thriving electric light company, which is very successfully operating a plant of 40 Weston lights.

The Western Electric Company have just put in operation, at Buda Pesth, Hungary, and Guttenburg, Sweden, one of their new multiple switch-boards.

According to the second volume of the census, 3,410,837 horse-power is employed in the United States. Of this, 1,225,379 is water-power, and 2,185,458 steam-power.

The London Society of Arts have offered £1,200, furnished by a member, to be awarded in prizes for essays on dwellings for the poor and the reconstruction of central London.

Over two hundred of the most prominent citizens of Portland, Maine, signed a petition to the Mayor and Aldermen of that city on Tuesday last, asking that the principal streets, squares and promenades of the city be lighted with the electric lights.

With a Skrevanoff battery of a weight not exceeding three and one-half ounces, it is asserted that M. de Monnier recently obtained an electromotive force of 1.45 volts and a current of 1 ampère for an hour.

At the temple of Kroto, Japan, is the great bell cast in 1633. It is eighteen feet high, nine feet in diameter, and nine and one-half inches thick. Its weight is nearly 74 tons. About 1,500 pounds of gold are said to have been incorporated in the composition. Its tone is magnificent. When struck with the open hand its sound can be heard at a distance of a hundred yards.

Mr. D. Boyd, one of the original organizers and holders of stock in the first telephone company in London, (and later on the principal promoter and investor in the Edison, Gower, and Crossley telephone patents, organizing the United Telephone Company, of London, also a director in the Lancashire and Cheshire Telephone Company,) returned to London last Saturday, after a three months' visit in this country. Since his sojourn here, he has effected the sale of the Clark patents on the electric portable battery and gas igniter to a company which he has recently organized, composed of some of the principal men in the electrical field here, whose names are a guarantee of success.

Mr. Boyd has secured for his English company the patents for gas igniters, combination bells, telephone and medical batteries, electric cigar lighters, and several other minor patents, with which, in the hands of such gentlemen as compose his company, a very successful business may be confidently expected.

Mr. Frank W. Harrington, superintendent of the Western Electric Company at Boston, will accompany Mr. Boyd home to England. Mr. Boyd has deservedly won the confidence of his American cousins, and carries with him many valuable inventions on incandescent lamp-lighting systems, and other electrical matters which he has made arrangements to exploit in Europe, and if he carries the same energy into that field as he has shown here, a profitable return may be expected by those associated with him.

The Progress of Electric Lighting.

We extract from a recent paper read before the Society of Arts in London, by Prof. William H. Preece, F. R. S., the following interesting comments on the above subject. He could have made a more favorable showing had he followed more closely the rapid advance of the business in this country:

"I scarcely think that the true solution of isolated house lighting will be secured until we can obtain reliable, effective, and economical secondary batteries. Planté's original accumulator, as improved by Faure, Sellon and Volckmar, has not yet reached that stage of perfection that one could wish to see, but the progress towards this desideratum is steady and promising. Planté has himself made a decided improvement by preparing his lead plates in nitric acid, and the experiments that I have made with his cells, as supplied by Elwell and Parker, of Wolverhampton, are so encouraging that I am about to use a set of them in my own house. A secondary battery has this advantage, that your electricity is stored up to be used when you want it, by day or night, without the constant use of machinery. In ordinary houses, such as mine, there ought not to be required more than one day a week for charging—a day set apart for the purpose, like washing day—when sufficient electricity should be stored up for a week's work. I scarcely hope to do this yet, but it is well within the bounds of possibility.

"I have indicated to you the direction in which progress has been made. The output of the apparatus has been greatly increased, and, therefore, the capital required for installation reduced, the expenditure on conductors has been considerably diminished, the efficiency of the lamps—especially in their durability—has been improved, and all these steps in advance have the tendency to economize the production of the electric light. But the progress is being continued, and there is vast room for this improvement. Nothing approaching finality has yet been reached.

"I see no reason whatever why our public streets should not be as efficiently lighted by electricity as they are now by gas, and for the same price. But the public are not satisfied with the same illumination; they will have more light. They are spoilt by the dazzling splendor of the arc lamp, and they treat with contempt the less showy glow lamp. Nevertheless, the best lighted street in the city of London is the Holborn Viaduct. Blackfriars Bridge, Bridge Street, Ludgate Hill, St. Paul's Churchyard, and Cheapside have been lighted by 38 Brush arc lamps for three years. We are now engaged in a very interesting series of experiments at Wimbledon, to determine the best and most efficient way of lighting public streets, and much value in an economical sense will, it is hoped, accrue from these trials.

"It is remarkable how the use of electricity is growing in favor with theater managers. Supported by the success of the Savoy, the Criterion, and the new Prince's Theater in London, the Prince's Theater in Manchester, the Prince of Wales and the Royal Theatres in Birmingham, the two theaters in Glasgow, and many others, are following Mr. D'Oyley Carte's spirited venture, and who can refrain from wishing that all would follow his example? Cool and pure air, absence of headache, and cheerfulness of mind are experienced at the Savoy, while the reverse is felt elsewhere where gas is used. I have recently examined the estimates for lighting up the Opera House in Vienna, and I have every reason to believe that less than thirty shillings per lamp per annum will brilliantly illuminate that beautiful house, and give a handsome return to those who have undertaken the contract.

"There are many small central stations at work in England, but none on a large scale. At New York there are several. The Edison Company's first station lights 431 houses, and 10,300 lamps, and they are now erecting two new ones for 50,000 and 70,000 lamps respectively. We have in London one at work on the Holborn Viaduct, another at Brixton, and another for 5,700 lamps will shortly be opened at Victoria Station. There are small central stations at Godalming, Chesterfield, and Colchester. The Hammond Company have one at Brighton, which works over an area of seven miles. This company maintains 900 arc lamps and 5,500 glow lamps in different places in England. There is a central station at the Edgeware Road Station of the Metropolitan Railway, whence Notting Hill Gate, Gower Street, King's Cross, and Aldgate Stations are lighted over a length of 15 miles long. 151 glow and 5 arc lamps are illuminated by the distributing system of Gaulard and Gibbs. Lord Salisbury, an amateur electrician of no mean type, has established quite a system of his own at Hatfield. The *Times*, ever in the van of progress, has for four years lighted up its printers' and compositors' room.

"Our new Law Courts are admirably lighted, and some of the judges have said that the electric light is the only good thing in this Palace of Justice. The House of Commons has gradually been fitted up, and the Colonial Parliament Houses in Cape Town and New South Wales are following the examples. Indeed, restaurants, hotels, and public buildings are all testifying to the fact that I am so anxious to bring before you, that electric lighting is a decided success, for they are using it. But we want to see it in our homes. An excellent little book on this point has recently been published by Mr. Hammond, which is well worth your perusal. He has given there a table so striking and convincing that I have had it copied and suspended for your information:

"The following table shows the oxygen consumed, the carbonic acid produced, and the air vitiated by the combustion of certain bodies burnt so as to give the light of twelve standard sperm candles, each candle burning at the rate of 120 grains per hour:

Burnt to give light of 12 candles, equal to 120 grs. per hour.	Cubic feet of oxygen consumed.	Cubic feet of air consumed.	Cubic feet of carbonic acid produced.	Cubic feet of air vitiated.	Heat produced in lbs. of water raised 10° F
Camnel gas	3.30	16.50	2.01	217.50	195.0
Common gas	5.45	17.25	3.21	348.25	278.6
Common oil	4.75	23.75	3.33	366.75	233.5
Bensole	4.45	22.30	3.54	376.30	232.6
Paraffin	6.81	34.05	4.50	494.05	361.9
Camphine	6 65	33.25	4.77	510.25	325.1
Sperm candles	7.57	37.85	5.77	614.85	351.7
Wax	8.41	42.05	5.90	632.25	388.1
Stearic	8.82	44.10	6.25	669.10	374.7
Tallow	12.00	60.00	8.73	933.00	305.4
Electric light	none	none	none	none	13.8

"There you see why the electric light is so pure and so healthy. There is no consumption or pollution of air. There is the smallest possible production of heat. There are none of the existing dangers from fire or suffocation, but all is pure, healthy, and safe.

"Our homes on the sea—those ocean palaces that render voyages to America and our colonies a pleasant yachting picnic—are being gradually fitted. Over 60 are already so fitted, and all will soon be done. None but those who have tumbled and tossed on the angry ocean in a pitch-dark confined crib for the seemingly never-ending night, can appreciate the peace and comfort of the soft and gentle little glow-lamp that is now supplied.

"Efforts are being made to introduce primary batteries for the generation of electric light currents, but not as yet with marked success. Unless the products of combustion can be sold profitably, primary batteries must necessarily be costly, and their constant renewal, and the amount of personal supervision they demand, militates much against their use; but some admirable batteries for small and temporary installations have been brought out, notably that of Mr. Holmes. Our railway trains are being lighted. Very satisfactory experiments are being made on the Brighton, South Western, South Eastern, Metropolitan, Midland, and Great Northern Railways, with dynamos, primary and secondary batteries, and there is no doubt whatever of their ultimate success. There is no reason why the energy of the moving train itself should not produce currents of electricity to illuminate every compartment with the light of day.

"Exhibitions have been both banes and antidotes. They have had much to do with the cause of the late mania, but they have also encouraged invention, and stirred up emulation. Last year's Fisheries Exhibition did much to educate Londoners to the advantages of the light. This year's Health Exhibition will do more; and I venture to prophesy—a foolish practice, unless you know—that this exhibition will, as an electric light display, be the best we have ever seen.

"There have been a good many failures in electric lighting, as there must be in the introduction of every new enterprise; but every failure can be traced to imperfect apparatus, or to the employment of inexperienced contractors—in fact, to bad engineering. It is not long since that the wiring of a large building was let to one firm and the lighting to another, with the necessary consequence that the whole thing 'burst up,' to use an Americanism, on the night of opening.

"It is difficult to express any opinion on the economy of the electric light. We have not had the experience of any central lighting station of sufficient magnitude to justify the formation of such opinion. Any comparison between gas and electricity on this basis is unfair, because gas is produced in quantities sufficient to supply hundreds of thousands of lamps, while the largest electric light station yet erected does not light up 10,000 lamps. In New York the price is the same for electricity as for gas; but then gas costs 12s. per 1,000 cubic feet, as it did in London, in the memory, perhaps, of some present. Nevertheless, the cost of supplying electricity now is far less than was the cost of supplying gas in the early days of its introduction.

"But why draw a comparison? People do not compare the cost of gas with that of candles, nor the price of a pheasant with that of a mutton chop. If we want a luxury we must pay for it, and if the price of the luxury is not too great, people will have it. People will have the electric light if it can be supplied to them, not because it is cheap, but because it is safe, healthy, pure, soft, and natural. And, moreover, they will not object to pay any reasonable price for it, whatever may be the price of gas. Gas is most destructive, unhealthy, and objectionable when used for artificial illumination. The proper function of gas is the production of heat, and we see in this room how this production of heat can be utilized to form electric currents which diffuse about us a real luxury—pure light. When the electric light can be supplied, questions of sanitation, ventilation, and decoration will determine its use, and not questions of price. At present, for household purposes, it is a luxury for which we must pay; but the progress made is so rapid, and the room for improvement so great, that the day is not far distant when we shall cease to regard it as a luxury, and shall demand it as a necessity."

The Telegraph in China.

The correspondent of the London *Evening News* sends the following interesting account of the telegraph business in China:

The wisest expenditure of money which has been forced upon the Chinese Government by the French difficulty, and which is likely to prove permanently beneficial to the country in many ways, is the construction of the telegraph. Shanghai has thus been connected with Pekin, and Hong Kong with Canton. The Chinese Government is now engaged in constructing a line of telegraph from Canton to the borders of Tonquin, crossing the two provinces of Kwang-tung and Kwang-si.

A good deal of opposition was experienced

in making the Hong Kong-Canton line; the wires were torn down, the posts pulled up, and the men engaged in the work of construction were repeatedly driven away by the mob. Similar or even more determined opposition was anticipated in connection with the works now in progress, for the people of these two provinces are noted for their bitter antipathy to foreigners and foreign inventions. It is, moreover, popularly believed that the telegraph must seriously interfere with the good luck of the land it crosses. The Government, however, caused numerous placards to be previously posted in all the towns and villages through or near which the line of telegraph would pass, informing the people of its value to the Emperor in the difficulties which had arisen, and strictly charging them not to interfere in any way with its construction. A band of about 100 soldiers are engaged in the work under the superintendence of three Danish engineers; and as yet no opposition whatever has been met with. The work, however, is proceeding slowly; it was commenced upwards of a month ago, and has but just reached the first city in the province of Kwang-si; it will take a month or five weeks longer to complete the line to the Tonquin frontier.

It is not at all surprising that the telegraph should be a source of continual wonder to a people so ignorant of science as are the Chinese. Little knots of people may frequently be seen gathered round a post listening with gaping astonishment, but with the fullest confidence, to some wiseacre who is pretending to explain the *modus operandi*. He tells them that there is a devil in each post, that the posts are placed close enough together for the devil in one post to make himself heard by the devil in the next, that the wire is placed on the top of the posts merely to keep them in an upright position; anything of a slant would make the devil inside feel very uncomfortable. These devils, of course, speak a language which is both unintelligible and inaudible to the uninitiated; "foreign devils," however, understand it well, and so to send a message is a very simple thing. A "foreign devil" speaks it to the devil in the first post, he passes it on to the next, and so it reaches its destination, where another "foreign devil" receives and interprets it. Other explanations are sometimes given, but all of them are equally wide of the mark.

In any other country the construction of a line of telegraph would not be considered by the outside world a particularly important incident, but in China such an event is to those foreigners who know the country one of great importance. It not only brings the interior of China into direct communication with the other countries of the world, but it breaks the spell of that necromancy which has done so much to prevent the progress of the people; it throws a gleam of light upon that world of science of whose existence the people have been not only content but proud to remain in ignorance; it is a sign that the country is beginning to awake from that trance-like conservatism, in which it has slept for ages; and so the telegraph in China cannot but be regarded as the forerunner of those arts and sciences, that higher learning, that truer civilization, which must before long break down the mouldering barriers of China's isolation, and unite her to the brotherhood of Christian nations.

Cars Above and Tracks and Motive Power Below.

THE UNITED STATES CABLE ROAD AND SUBWAY COMPANY.

The work of the Rapid Transit Commission in New York, through the new routes they have laid out, has called public attention anew to the inconvenience attached to the present system of cars with their horse traction and obstructive tracks. While the facilities afforded by the surface roads in New York have made it one of the easiest and best cities to travel in the world knows, it cannot be denied that the principles of track construction are crude and productive of an infinite amount of damage to the vested interests of property-holders and men of business.

In London, a city of 4,000,000 inhabitants, spread out on a scale that approaches Philadelphia or the outskirts of Brooklyn, in the proportion of extensiveness to population—where "tram car" travel has become an absolute necessity, in spite of the admirable system of underground and substantial elevated railroads—tracks that in any way interfere with ordinary traffic are rigorously excluded from the streets, and in the minds of New Yorkers who have walked, ridden and driven in this and other cities, the question suggests itself, why should it not be so here? The opposition encountered by the Rapid Transit Commissioners on some of their proposed routes, where the inhabitants and occupants complain of the damage a track and horse-cars would cause to their business or the value of the thoroughfare for residence or pleasure driving, calls renewed attention to the subject; and at the same time to a means of obviating the inconveniences inseparably attached to our present methods of street surface railroad operation and track construction.

THE UNITED STATES CABLE ROAD AND SUBWAY COMPANY,

organized under the laws of the State of New York, with a capital of $250,000, own patents on inventions of Messrs. Orvis & Adams, covering an entirely novel plan of street railroad construction. They propose to operate the road by cable traction, the wheels of the car and the cable being underground. From the subterranean trucks, through a one-half, or five-eighths inch slot, set level with the pavement, two half-inch steel plates project, on which, by suitable flanges and brackets, the body of a passenger car is supported. There is no track to mar the level of the streets, the slotted or grooved apertures are flush with the street, no matter what its undulations, the openings are too narrow even to catch a toe-calk, much less a wheel or foot; there are neither frogs nor switches, and the heaviest loaded vehicles, as well as the lightest, could be driven directly or obliquely across the "track," or even turned on it, without perceptible jar or wrench.

Not only this, but the cars, devoid of horses, and made of a size to suit the thoroughfare through which they will pass, could run on streets where railroads cannot run as built at present; the crowded downtown thoroughfares could not object to such a conveniently small conveyance, any more than the up-town residents on fashionable avenues could complain of the noise, while the street surface would be equally unobjectionable in either case. Snow and ice would not obstruct such tracks in winter; sunstruck, "wilted" stock would be avoided in the hot months, and there would not only be an immense pecuniary saving to a company adopting the system, but no objection would be raised by property-holders on any route to their road, important considerations to both old and new railroad corporations.

The sub-way will be large enough to admit all wires of telegraph, telephone and electric light companies and will thus serve a double purpose. Arrangements to use this plan are now made for several smaller cities.

Preventing Corrosion and Scale in Boilers.

A paper on this subject was read at a recent meeting of the Society of Arts by Mr. G. Swinburn King. After some preliminary remarks, Mr. King stated that it had long been suspected that "galvanic action or electricity in some form had to do with corrosion and pitting." He then mentions the various theories on the subject, and alludes to the numerous patent compounds for curing these evils, remarking that "some compounds cure one part of the evil, and do not touch others, while some, again, are extremely dangerous to use in a boiler under steam pressure." The author then refers to the results of the labors of committees appointed by the Admiralty between 1874 and 1880 to inquire into causes of decay in the boilers of H.M. ships. "The main conclusion," he says, "at which the committee arrived—the great principle that they asserted and demonstrated—was that galvanic action, induced by the contact of zinc with the iron of the boiler, was the best and only trustworthy remedy for corrosion; and that so long as the metallic contact was maintained, little or no corrosion would go on. They adopted a plan of hanging slabs or plates of zinc by iron straps from the slags or rods within the boiler, the zinc being held in a clip in which it was tightly bolted. The theory was perfect, but the weak point in practice was found to be in keeping up electric contact between the two metals. The committee endeavored to circumvent this difficulty—first, by fixing in each boiler an excessive number of plates, so that, apparently, if electric contact should cease even in many plates it might chance to be maintained in some; and secondly, they directed a frequent examination with a view of renewing the contact and putting in fresh plates in lieu of those destroyed by corrosion. This system was the best they were able to arrive at, but it could be maintained only at such a cost that, to use the words of the report, 'the expense of the zinc necessary for efficient protection is undoubtedly an important element in determining how far it should be adopted.'" (It appears that the actual waste of zinc was much greater than that due to the protection of the boiler). The author then describes a number of experiments, all of which failed from the same cause, viz: destruction of the metallic contact between the zinc and iron from one cause or another. To remedy this, Mr. Hannay, an electrician, of Glasgow, designed what he calls an "electrogen," composed as follows (we quote from Mr. King's paper): "A ball of zinc, with a copper conductor cast through the center of it, the copper being so combined and amalgamated with the zinc at the junction of the two metals as to form brass. Thus no corrosion could form between them to stop the galvanic current. The zinc is well hammered at a certain temperature, ensuring long existence in an efficient condition. This ball is fitted in any convenient part of the boiler by a simple device, and a wire from each end of the copper conductor is soldered firmly to the iron. From this moment the electrogen keeps up an uninterrupted galvanic current, and the whole of the interior of the boiler is absolutely protected from corrosion so long as any of the zinc remains. It was ascertained, by further experiments, that a very small surface of zinc was sufficient to afford protection for a radius of twenty-five feet from the point of contact, and the spherical form of the zinc was adopted because it would maintain perfect protection with a minimum of waste, the large surface exposed by plates, in proportion to their bulk, being quite unnecessary. Herein, therefore, was the means of avoiding that waste which the Admiralty Committee stated was 'much greater than that due to the protection of the boiler," and for which they sought a remedy. Two electrogens are found in practice sufficient to protect an ordinary 'single-ended' marine boiler in which, by some engineers, forty or fifty plates would have been considered necessary. The electrogens will last for about six months, while the plates would probably corrode away in as many weeks. The zinc ball, with its perfect contact, generates a current of greater intensity than zinc plates mechanically fitted, and the consequence is that a portion of the water is slowly decomposed, and the hydrogen that is evolved at the negative pole, all over the surface of the iron and underneath the scale, forces off the scale in thin flakes by mechanical action as soon as it becomes thick enough to be impervious to the hydrogen. In this way the scale is kept forming and reforming, hanging in loose flakes, or falling off as it becomes detached from the iron. Thus all the evils attending incrustation, which have been before enumerated, are avoided. Fuel is saved, burning of the iron is prevented, and chipping becomes no longer necessary."—*Engineering.*

Artificial Light for Photography.

Many experiments have been made in this city and in other parts of the United States with the camera and electric light. Some experiments have also been recently published on the use of bottles of oxygen in which to burn fragments of magnesium riband to take portraits by the magnesium light. An objection to this form of light is the trouble and cost of making the oxygen, and that means have to be adopted to diffuse the light near its source. The objection to burning the riband in air is that the exposure is longer, and the burnt ash has a tendency to drop off and put out the light before the selected length of metal is consumed.

Some years ago Mr. W. H. Harrison had occasion to use the magnesium light by night, and overcame the difficulties by the adoption of one part of the principle of Larkin's magnesium lamp.

In the British *Journal of Photography* Mr. Harrison thus explains the method used:

"On the top of a firm and solid table is placed a base-board supporting a wooden upright some seven or eight feet long, consequently reaching nearly to the ceiling of the room. At the top is a kind of little brass funnel with no neck, and a large opening where the neck should be. This brass inverted cone was no larger than an egg-cup, and its lower opening was about as large as a four-penny piece. A tin spirit lamp, with a horizontal neck and flame, is placed below, so that anything falling through the funnel must pass through the flame, yet just miss touching the wick. The combustible substance was magnesium powder mixed with sand. One thimbleful of the powder, for instance, is mixed with two of sand with a spoon or bit of wood on a sheet of paper; then, the sitter being in position and all being ready, the mixture is poured all at once into the funnel. A long sheet of flame of one or two seconds' duration is the result. If the picture prove over-exposed, the proportion of sand has to be increased in the next trial, or that of the magnesium powder correspondingly diminished. When once the right proportions are known, portrait after portrait can be produced, properly exposed with dead certainty. No cap is necessary to the lens, provided a candle only is used for the normal illumination of the room, and it is not placed so that an image of it can be thrown by the lens into the camera.

"The proportion of magnesium powder regulates the proper exposure. At first there was a difficulty, and one only, with this simple apparatus, and that was that the aqueous vapor from the flame condensed on the lower parts of the brass cone, and the powder stuck to the neck of the wet funnel, sometimes blocking it and arresting the flow of illuminating material altogether. The neck of the funnel was therefore cut off, and the lower opening of the cone made rather large. It would be an improvement to use something on which aqueous vapor has less tendency to condense than upon cold brass. The brass, however, was subsequently kept hot by fixing the spirit lamp nearer to it than in the first experiments

"The larger the proportion of magnesium in relation to the sand, the longer the flame and the shorter its duration. With a very rich proportion I once had a flame seven or eight feet long, reaching the base-board and burning its surface. The long flames give the necessary diffusion of light, and a white sheet on the opposite side of the sitter improves the shadows. The finest artistic effects of light and shade on the countenance of the sitter can be obtained by this method when the lamp is placed in the proper position.

"The sitter need not be fatigued with focussing operations. A candle placed where his face will come will do to focus upon. In fact, it is a capital method for the comfort of the sitter, who must not look in the direction of the coming flame, lest his eyes be dazzled by its magnificent flash, which, however, lasts but a second or two."

This process is capable of many improvements, as was recently seen by the experiments recently tried at the Smithsonian Institution in Washington, and no doubt in the future it will prove expeditious and convenient to use magnesium in the photographic studios.

Telephonic News

The Cumberland Telephone Company of Tennessee has increased the quarterly dividend to 2 per cent. The company is meeting with great success in Nashville and Memphis.

A match by telephone between chess clubs in England is becoming quite a frequent occurrence, and is exciting great interest among the local chess players in the various places.

New York and Boston now talk by telephone, but the New Yorkers are already complaining that the Boston end of the machine is so plugged up with beans that it sounds like talking through a shot pouch.

The fight in the Legislature in Boston by the telegraph companies for the privilege of running their wires along the locations of railroad companies has been exceeding lively. A decision is expected next week.

At the quarterly meeting, just held, it was voted to increase the capacity of the Nashville exchange to 2,100 instruments. Memphis has increased the instruments in use there from 450 to 675 since October.

The exchange in Erie, Pa., has been increased over 75 subscribers in the last three months. The receipts for messages during the last month amounted to $150, an increase from the receipts of December of $145. In the last month 28 new lines were built and 26 miles of new wire strung. A line of new cedar poles along the east side of State Street is being rapidly raised.

The New England Telephone and Telegraph Company having leased an entire building opposite their present location on Pearl Street, Boston, alterations are in progress, and the new location will be ready for occupancy in a few weeks. Offices are being fitted up for the executive officers, the main office of the Boston division, and quarters will also be provided for the construction and repair departments.

The Erie Telegraph and Telephone Company have complete returns from their various divisions, for the months of January and February, 1884, which show an increase of 300 subscribers, making a total, March 1, 1884, of 8,662. The receipts for the quarter ending Dec. 31st, 1883, (March being estimated on a basis of January and February), they will amount to $134,681.46, an increase of over $4,000.

Many of the difficulties which beset telephoning are already familiar to thousands. Those who have tried to catch the "wee, small voice" of the distant talker amid the hubbub known as "frying-pan noise" have some idea of the effects of induction. That is what comes in from other wires, but on long-distance telephoning there is the difficulty from what gets off the speaking wire. The quicker the wire can carry the current the less this difficulty becomes. Hence, on pure copper wire the telephone operates well over such distances as from here to Boston, and even to Washington, as was done the other day over the Postal Telegraph lines. But even copper wire has its limits of telephonic conductivity with the low electrical force at present used. With absolutely perfect insulation even this could be managed, but no electric wire cable has been invented yet that does not leak a little. The great problem, then, which electricians are trying to solve is how to increase the electric energy without destroying the conductor.

Kansas City and Northwestern News.

KANSAS CITY, MO., April 9th, 1884.

The decided increase in the number of telephone subscribers in the territory controlled by the Missouri and Kansas Telephone Company, during the past thirty days, speaks well for the energetic management. There have been heavy expenses in the way of reconstruction and construction of the various exchanges, and although this progressive spirit will cause expenses to be burdensome for some time to come, yet that this is the only proper way to fully develop telephone territory is already well substantiated by the now rapidly growing exchanges all all along the line where improvements and extensions have been made.

The enterprising little City of Mexico comes smiling to the front and points with pride to the fact that its energetic citizens have doubled the number of telephone subscribers there during the month of March. Other cities in the territory mentioned are making very creditable showings, and the demand for telephones seems to be on a general increase. In this city the past month has been marked for the rush that has pervaded telephonic circles. At least four (4) miles of new poles have been planted, opening all the eastern part of the city to the reach of the telephone; a multiple switchboard of the latest pattern has been connected to the three already in use here, the work all being done in the night, so as not to disturb the lines that were busy during the day; and last, but not least, sixty (60) new subscribers were connected with the exchange, and not one telephone discontinued. Notwithstanding this healthy increase the demand still continues, and to-day the manager reports about two dozen applicants unsupplied. Several additional cables have been strung in the last few days, one of them extending about half a mile from the central office. The cables, after a six months' trial, are proving quite a success, and will soon largely do away with the network of wires, not only in this city, but in many others in the West.

At the meeting of the city council of Wyandotte one evening last week, a franchise was granted the Missouri and Kansas Telephone Company to build an exchange in that city. Wyandotte is a growing town of about 10,000 inhabitants, just across the Kansas River from Kansas City, and will no doubt sustain a good-sized exchange as a branch of the Kansas City system, to which it will be connected by probably a half-dozen trunk lines. The exchange will be established in a few weeks.

Mr. Geo. L. Phillips, President of the Missouri and Kansas, and United Telephone Companies, and also the well known assistant general manager of the American Bell Telephone Company, was in the city last week, and while here submitted to an interview, containing much that was pertinent to the present status of telephone matters. Among other things in operating the Kansas City exchange, he said:

"Our business has grown very rapidly within the past year, and the prospects are that it will fully double itself within the twelve months to come. We are constantly changing, improving and enlarging our apparatus and we hardly get the exchange, as we think, in perfect working order with all of the latest improved appliances to make the service faultless, when some new and important improvement is made in the switch-board or other apparatus, and to keep step with the progress of the age we are obliged to put everything in new again. The public are, however, scarcely aware of the constant changing that is going on in the central office, for everything has been reduced to such a fine system that an entire switch-board can be changed without a single subscriber being interrupted.

"Kansas City is already the center of a large telephone circuit, embracing the cities of Independence, Wyandotte, Lawrence, Topeka, Leavenworth, Atchison and St. Joseph, and it is our intention to very materially enlarge this circuit within the present year, just as fast as trunk lines can be built and other arrangements completed, all of the principal exchanges in the States of Missouri and Kansas will be in talking connection with each other, through Kansas City, as the central exchange. This circuit, when complete, will be the most important one ever put in operation, and will include, in addition to the points already mentioned, the cities of Olathe, Fort Scott, Osage Mission, Parsons, Emporia, Junction City, Wichita and other points in Kansas; Rich Hill, Butler, Joplin, Carthage, Nevada, Cameron, Sedalia, Jefferson City, and I may say St. Louis, in Missouri, although up to the present time no successful method of overcoming the induction which interferes with the working of trunk lines, covering a distance so great as that between Kansas City and St. Louis, has been discovered. For distances of 150 miles we will be able to work successfully, and in my opinion before very long some apt inventive genius will discover means of overcoming induction, so that lines 300 or 500 miles long can be successfully operated, and an ordinary tone of voice heard distinctly between Kansas City and St. Louis, or Kansas City and Chicago. This being once accomplished, there will be no limit to the possibilities of telephonic progression."

"What do you mean by induction?"

"In electrical parlance, it is the influence by which an electrical current produces magnetic polarity in certain bodies near or round which it passes. To explain: When two wires charged with electricity are strung in close proximity to each other, induction causes a flow of electricity from one to each other through the air without actual contact, and in telephone business this interferes with the working of lines, for the reason that the conversation on one wire can be heard upon another wire running parallel to it. On short lines this is not noticed, for the reason that the wires are not sufficiently charged with electricity to cause induction to any great extent, but in long lines the electrical current is so strong that conversation will be carried from one line to another by induction on parallel wires as far as sixty feet apart. This is why long line telephonic communication is not a success, and it never can be until some method of overcoming the induction is discovered. This is a problem which has been worked at hard and long, and without apparent success, by the ablest electricians of the age, but the case is by no means hopeless, for a key to the situation is liable to be discovered at any time and when we least expect it. In fact, a young Eastern inventor is now working on the problem, and his hopes of success are quite flattering. When this is discovered the limit of telephonic communication will scarcely halt upon the shores of the ocean, although it will take numerous other important discoveries to render the ocean telephone even possible.

"In this regard, however, I may say that if the history of the rapid strides of progression which followed the discovery of the telegraph, or the wonderful improvements in the telephone since its discovery or invention, is to be taken as a basis of calculation, the successful operation of the ocean telephone may safely be classed as one of the possibilities or even probabilities of the future. This is truly an age of progression and inventive genius, and there is no telling what may yet be evolved from the mind of man. Electricity is one of the greatest studies the world ever knew, and there is probably no branch of science which has such wonderful possibilities ahead of it."

The A., T. and S. F. Railway Company is having its telegraph system connected with its new and elegant general offices in Topeka. The offices of the superintendent of telegraph, Mr. R. B. Gemmell, are located in the top story, and will be as well arranged for practical work as any in the country. Chief of Construction James O'Day is doing good work in stringing the many wires through the city, and will have everything ready by the last of next week.

An elaborate system of private line telephone and messenger calls, mentioned in a former letter, has been arranged in the new general offices, and will be ready for use by the time the building is occupied—May 1st.

The State House flag staff at Topeka is fully 200 feet from its highest point to the earth, and when it became necessary to put on a new rope, a few days ago, the State officials were at a loss to know where to find a man to climb the slender stem that extended so far above the roof of the capitol. A happy suggestion was made that the man who could climb the telephone poles in the city was the party to help them out, and Manager Geo. Bayless, of the telephone company, was sent for, and did the work himself with "neatness and dispatch." Bayless is not only an excellent manager, but, as this feat proved, is a skillful climber.

Many of the Western Union gangs have been called in, and linesmen are now quite numerous in Kansas City and St. Louis. Until a thorough understanding of what the United States Government intends doing is had, the Western Union Company will not likely run many new lines.

The other day a subscriber rang up in great haste, and told the central office at Kansas City to connect him with 362, a hasty glance at his telephone directory causing him to believe that hat was the number of his physician's telephone, he desiring the disciple of Esculapius to call and see his sick child. Imagine his dismay on inquiring "Who is that?"—an expression so inelegant that it is unfortunate that the telephone has to bear the blame of its now most general use—to be told, "This is Stine, the undertaker—do you want a coffin?" To the superstitious I beg to remark, however, that the child recovered!

Chas. W. McDaniels, of Carthage, Mo., after an extended trip East, has again united himself with the telephone world of the West, and will devote his time to the development of the territory of the Missouri, Kansas and United Telephone Companies.

There is constant inquiry among telephone exchange managers for a motor for use in their exchanges—a motor that can be depended on in wet weather or dry weather, Sundays or Mondays, and at night or at day. In this city the power comes from a grist mill, which runs when it has enough wheat to keep it busy, and also from a steam printing house, that shuts down at night, noons, and Sundays; and on these occasions the very entertaining work of turning a hand generator is made necessary. The electrician with his electric motor can now step to the front and be hailed with joy. If any of your readers know of an improvement over the grist mill scheme, that doesn't cost a fortune to secure, I hope his mention of the fact will find place in these columns soon.

The Union Pacific Railway Company is stringing a line from Concordia to Lawrenceburgh on the Junction City and Ft. Kearney branch of their road. They have one of the best managed telegraphic systems in the country, and are constantly making improvements and extensions whenever they become necessary.

During the month of March, the cities here named had new telephone subscribers connected as follows: Topeka, 10; Lawrence, 8; Leavenworth, 12; Atchison, 7; St. Joe, 6; Hannibal, 5; Kansas City, 60.

Many western people are taking quite an interest in the experiments between Boston and New York, under the supervision of E. T. Gilliland and others. Those who know Mr. Gilliland are confident he will make a success of this long line if a success is possible.

BI-POLAR.

The New England Telegraph Company of Boston, with a capital of $30,000, for the general business of telegraphy, both within and without the limits of the commonwealth of Massachusetts, has been incorporated in Boston. Winfield S. Hutchinson, President; Steuben T. Bacon, Treasurer.

The Indians in Alaska are said to have used, in making salmon nets, the bulk of 900 miles of telegraph wire, which was laid by the Overland Telegraph Company many years ago, at a cost of $3,000,000.—*Major D., Old Guard.*

The Portland, Me., Telephone Exchange.

We give in this issue an illustration of the telephone exchange at Portland, Me. This is the largest exchange in the State, and numbers about 800 subscribers.

The Williams switch, with some modifications, was placed in the new, airy office several months ago, and has been partially described in a previous issue of the REVIEW. We will only add a description of a few of the novel features in this system, which, with use, seem to commend further adoption.

Subscribers working often with each other are placed on the same section. The sections are numbered instead of being lettered, and the section number represents the hundredth number of all subscribers on that section. Six connections can be had between any two sections at the same time, and yet the sections are not large and out of convenient reach of the operators. The device by which this is accomplished is new, and is covered by two patents. A neat switch in the wall of the room (behind section 5 in the cut) is arranged so that, by moving two pins, any section can be supplied with a fresh transmitter battery, without for a moment interrupting the service. Call battery and magneto currents can also be tested and rearranged at this switch.

The wires go to cupola in iron steam pipes, making neat appearance and safe arrangement. The lightning arrester is formed of a one-fourth inch copper rod, set nearly its size into a groove in a strip of walnut; over the rod is placed a strip of dry, varnished paper, and over this and at right angles to the copper rod are screwed the line strips, the copper rod being connected by a 9-inch copper wire to both water and gas pipe. This has proved to be an excellent arrester. It has been used in connection with the old office for four years, and, although many subscribers' instruments have been injured by lightning, there has never been but one annunciator magnet disabled at the central office.

The wire leading from the arrester, before reaching the ground connection, passes through a heavy switch, which can be opened in case it is desirable to test for grounded line in the arrester. While the multiple switch, which has been considerably improved since the change of office and system at Portland, and is undoubtedly the best switch for very large exchanges; this system in general, and in all its details, works admirably in Portland, and gives the best of satisfaction to subscribers. The chief operator says as long as the subscriber does not put the wrong end of the telephone to his ear, there is no complaint.

The new office was equipped under the able management of the Lowell syndicate, who believe that *good* service pays *best*. Much credit is also due Supt. Farnham, who has worked untiringly, not only for the improvement of his own exchanges, but for the business in general, and who has added these and many other improvements in telephone apparatus.

The quarterly meeting of the directors of the Erie Telephone Company was held last Tuesday in Boston. The auditor's report for the quarter ending Dec. 31, 1883, showed that the company had earned $130,457.56 and disbursed $64,248.86, leaving the net earnings, $66,208.64. Deduct the quarterly dividend paid January 25 of 1 per cent., $48,000, and there remains a surplus of $18,208.64, which, added to the previous surplus of $30,239.36, makes a total surplus of $48,448 to January 1, 1884. The increase of subscribers for October, November and December was 812; for January and February, 300; total number connected March 1, 1884, 8,728. The gross earnings for the quarter ending March 31, estimating March, show an increase of $4,000 per month. At the present rate of increase the officers of the company state that by August 1 the company will be able to carry on its entire construction, paying operating expenses and a dividend at the rate of 4 per cent. per annum on the issued stock, 48,000 shares. A dividend of 1 per cent. was declared, payable April 25, 1884, to stockholders on record April 15. The books will be closed from April 16th to the 25th, inclusive.

Married by Telephone.

Quite a novel wedding took place in Weatherford, Tex., last week. Mr. J. M. Hudson and Mrs. Leave of Dallas came to be married, and, owing to the fact that the clerk was dead and his successor had not been appointed, they could not get any license. They telephoned to the clerk of Palo Pinto county and had him issue them a license; but still they were in a dilemma. They could not get it from there under twenty-four hours, so they roused up Judge Taylor and were married by telephone, each holding a telephone to their ear until the solemn words "man and wife" were pronounced.

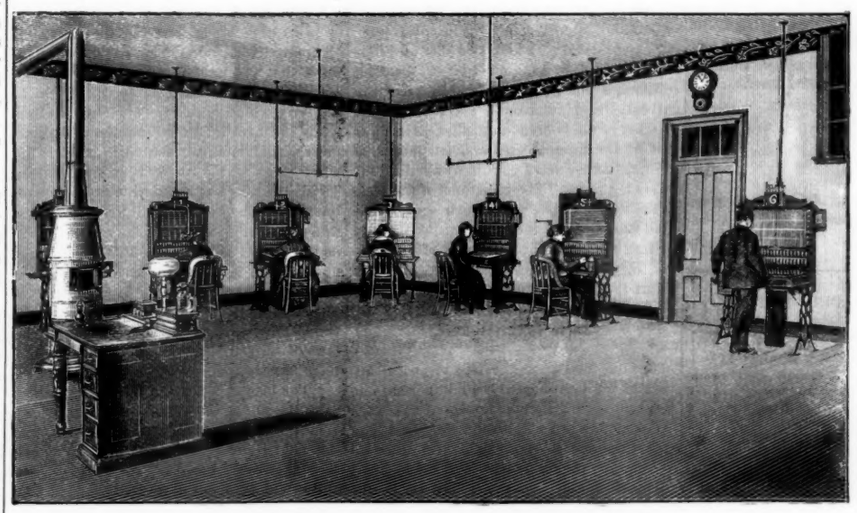
The Baltimore and Ohio Seeking Admission to Massachusetts.

The Baltimore and Ohio Telegraph Company are making persistent efforts in every direction to secure an entrance into this State for their lines. They are pressing with vigor before the Legislature to secure the passage of a bill to permit the occupation of railway locations by telegraph lines. This step being urged as a necessary means to avoid the exclusive features of existing contracts between the railroads and [the Western Union] Company. The railroads and the Western Union Company are strenuously opposing the legislation, and the evidence has been protracted to great length. Meantime, the Baltimore and Ohio have made application to all the railroads for the right of occupation upon their locations, and also that the railroads will afford such facilities in the transportation of materials, including distribution between stations, as have been afforded to the Western Union.

It is understood that the Baltimore and Ohio has material ready for distribution along the line of the New York and New England Roads, and this railroad having refused such facilities as the telegraph company desired, the counsel of the telegraph company, Messrs. C. Chandler and Benjamin Kendall, on Wednesday filed a petition with the Railroad Commission asking for an investigation and relief. One petition says that they are informed and believe that the refusal is given because of supposed obligations contained in one or more contracts between the New York and New England Road and the Western Union, containing provisions designed to prevent or discourage the extension of any telegraph line in competition with the Western Union, which provision the petition claims to be illegal and void, being contrary to public policy, in obstruction of trade, and opposed to the laws, both of the United States and the Commonwealth of Massachusetts.

The Commercial Telegraph Company, which is controlled by the Bankers' and Merchants', and the American Rapid Telegraph Companies, reports progress, the rights for the latter within four States having been leased within the past few days at a rental which it is guaranteed shall not be less than $500,000 during the next 12 months.

General Superintendent Zeublin, of the Baltimore and Ohio Telegraph Company, during the recent riots in Cincinnati, on account of the murderer Berner trouble, looped the B. and O. wires into Governor Hoadley's office in Columbus, O., giving the Governor direct telegraphic communication with the civil and military authorities in Cincinnati. Governor Hoadley is president of the Baltimore and Ohio Company in Ohio and his firm—Hoadley, Johnston and Colston—were the counsel for the B. and O. Company in the recent injunction suit against the New York, Chicago and St. Louis Railway Company, tried March 24th in Cincinnati, before Judge Baxter, of the United States Circuit Court, which was decided in favor of the B. and O. A peculiar circumstance connected with this case was that, although the suit was against the Nickel Plate road, and the Western Union Company were not in any way connected with it on the records, yet General Wager Swayne and his brother, Frank B. Swayne, of counsel for the latter company, were the only counsel who appeared for the railroad company, showing that the Western Union Company were the real parties in interest against the Baltimore and Ohio.



PORTLAND EXCHANGE (SHOWING 6 OF THE 12 SECTIONS.)

The Bankers' and Merchants' Telegraph Company.

At the annual meeting of the Bankers' and Merchants' Telegraph Company, three-quarters of the stock was represented. The president reported mileage of the company increased during eight months from 295 miles of pole and 1,995 miles of wire, to 6,697 miles of pole and 46,447 miles of wire. Work now under contract, to be finished in six months, will increase pole mileage to 10,000 and wire to 100,000 miles, and reaching nearly every paying point east of the Mississippi River, and for which all financial requirements have been provided. The old board of directors was re-elected, and also the old officers.

An Adverse Decision on the Postal Telegraph Scheme.

The House Committee on Post Offices and Post Roads, on Friday last, by a vote of 8 to 2, adopted the following: "Resolved, That it is the sense of this committee that it is inexpedient for the Government either to construct a postal telegraph or purchase any existing line of telegraph." Messrs Bingham, of Pennsylvania, and Peele, of Indiana, voted in the negative; and Messrs. Money, Reese, Ward, Cosgrove, Riggs, Rogers, Jones of Texas, and Wakefield in the affirmative.

The Drawbaugh people are out with another pamphlet to assist in the selling of their stock. This pamphlet starts out with this statement:

"The financial success of the telephone business is unprecedented in the rapidity of its growth and the extent of its earnings. Scarcely four years ago the system of exchanges was inaugurated, and now the Bell Company have seven hundred licensees, using several hundred thousands of telephones, and a present increase of 5,000 subscribers a month.

"The aggregate capitalization is over $100,000,000, and the best authorities estimate that in the not distant future this present rate of development will enable the business to earn 6 per cent. on $500,000,000 capitalization."

A Boston contemporary says that the Drawbaugh methods of work are certainly ingenious. They first enter a city or town with a long article in a local paper descriptive of the success of the Bell telephone and the fortunes it has made for the present managers set down, usually without any regard for the facts, at five or six millions for each of several men who are still salaried officers of the Bell Company. Next a prospectus, containing statements like the above and a description of the Drawbaugh claims, is circulated. Possibly it may be marked "Printed for private use only." Then the place is drummed for purchasers of Drawbaugh telephone stock. Now, the fortunes made by the original investors in Mr. Bell's invention are very much over-estimated. The capitalization in the beginning, when business men were timid, the patent in litigation with the Western Union, and the invention generally regarded as a toy, was but $350,000. Then various issues were sold until the capital was $850,000, and here the striking profit of the original investors was made. Six shares of new stock were given for one original share. No other stock dividend has been made, but 6, 8 and 12 per cent. dividends have been paid in cash, and stock worth a premium has been sold to stockholders at par to raise new capital for the extension of the business. When telephone stock now at 160 was near 300, and the exchange stocks now at 30 were selling at 110 to 140, the capitalization of the Bell telephone in parent and sub-companies was selling at not far from a hundred millions, and the ideas concerning the future, which we vigorously attacked at the time, were decidedly wild. Now the capitalization of the telephone exchanges of this country, as they have been straightened out and reorganized by the American Bell Company, is a little short of $51,000,000, of which $20,000,000 is in the treasury of the parent company, which in time will gain five millions more. Not more than $30,000,000 can therefore be counted as live capital in the sub-companies. The average worth of these stocks upon an eight per cent. basis is about par. Allow the capitalization of the Bell Company's bonds and stock to be ten millions and 160 the price, the parent company is selling for $16,000,000. Add these figures for the parent company to the live capital in the sub-companies, and the total capitalization of the Bell telephone interest is not above $40,000,000, and its market worth is not above $46,000,000 All the other figures quoted above from the Drawbaugh pamphlet are also false. There are 125,000 telephone subscribers in this country, and the rate of increase is less than 2,000 subscribers per month, instead of 5,000. as stated by the above quoted pamphlet. If the Drawbaugh statements about their own affairs are no more accurate than their statements about other people's affairs, they are not entitled to an extended public hearing, and we bid them "Good day."

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We extend to manufacturers of electrical apparatus an invitation to send to this office any and all facts concerning their business which will be of interest to the public. We make no charge for publishing news.

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NEW YORK, APRIL 17, 1884.

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Re-enforcement of Sound.

In a recent number of our esteemed contemporary, *La Lumière Electrique*, M. Goloubitzky describes some very interesting experiments made by him in the application of the microphone and telephone to the reinforcement of the feeble sounds of a muscular current. On causing such a current to pass into a telephone, and interrupting it, a very feeble sound was obtained. He succeeded in reinforcing this considerably by the following system: To the iron plate of the telephone, through which the muscular current was passing, a microphone was adapted. This latter was of the Wreden type, which is lighter and more easily regulated than others. It made part of a circuit which included, in addition, a pile and an induction bobbin, and the fine wire of the bobbin was connected with a second telephone. To the plate of this latter there was likewise fixed a microphone, included in the same way in the circuit of a pile and a bobbin. The induced wire of this bobbin was connected with a third telephone, and so on. He employed in these experiments only three telephone-microphones. The fourth, which was of the ordinary style, served for receiving the reinforced sound, and was placed in a distant spot, separated by several rooms.

The following are the results obtained with this apparatus. The muscular current that operated the first telephone set in motion, at the same time, the microphone that was adjusted to the telephone plate:

"If the microphone is properly regulated, there is always obtained a sound which is a little stronger in the second telephone than it was in the first. The second microphone will reinforce again the sound transmitted, and in the third it will be yet stronger, and so on. In experiments made by the aid of three telephone-microphones, the sound was so strong in the fourth telephone (provided with a speaking trumpet) that it could be heard very distinctly at a distance of several meters. On placing a watch upon the first microphone, I obtained in the last receiver a sound analogous to that of the drum."

Mr. Woukouloff, who made similar experiments, says: "I am unable to continue my experiments with regard to the application of this apparatus to the reinforcement of all the sounds transmitted by the telephone and microphone, so I publish what I have done in hopes that some one else will take up these interesting researches."

Desiring to verify the results obtained by Mr. Woukouloff, especially because they are in contradiction to the principle of the conservation of energy, I have made the following experiments: "I took two piles of different forces, two induction bobbins of different resistances, and microphones of different sensitiveness and resistances I reversed the position of the bobbins and piles, as well as that of the microphones and telephones, at different times, and I constantly obtained the following result. The vibrations of the plate in the telephone, t^2, were much more feeble than were those of the one connected directly by fine wire with the fine wire of the bobbin, *B*. This experiment will do much to refute the theory set up by M. Woukouloff."

As to Light-Houses.

The question as to the best electrical apparatus for light-houses is an important one just now, seeing that we are about to erect a series of first order lights on the coast, and that Congress is showing a disposition to appropriate the funds that will be required to substitute electricity for lard oil in the most important light-houses.

In England Sir James Douglass and several other scientific men are about to institute a series of electrical experiments on behalf of the Trinity Board, with their existing electric lighting machinery, and an enormous De Méritens machine, at the two light-houses near Dover. Dynamo machines do not appear to rank as the best generators for light-houses; as a certain description of induction machines have held their own at this important light-house, and amongst the trials about to take place, a De Méritens large size magneto generator will be installed, which is expected to yield magnificent results. These machines of De Méritens will soon occupy all the light-houses on the French coast, and it is to be hoped that these generators will be given a trial here. The late Counte du Moncel, in one of his works, speaks of their high power as compared with the small force required to drive them.

In this machine alternate currents are produced, and the whole of the armature is utilized during its entire or part revolution. This form of armature also requires but little horse-power on account of the peculiar arrangement of the circular magnetic field it rotates in, on a smaller scale as in the factory machines, which yield about twelve hundred candle-power at about seven hundred and fifty per minute and absorb only 1¼ horse-power.

The small machines contain about three cwt. of steel inducing magnets with their poles placed alternately N. and S., which operate upon sixteen annular magnets forming a ring tire armature which are arranged on the periphery of a brass wheel. Each annular magnet contains about 1½ lbs. of wire, and the iron core is built up of pieces of iron, instead of being solid castings, which heightens the induction effects, and also prevents the formation of injurious Foucault currents. Two brilliant electric lights have hitherto been visible for many miles at sea from the South Foreland Light-house on the English coast, but the experimental installation soon to take place will, no doubt, eclipse the light at present emitted from the two lanterns on the tower. It was from these light-houses Prof. Tyndall carried out his famous experiments on sound by a fog siren driven by the engines of the lighting machinery.

Correctly Interpreting Newton.

The real signification of Newton's great discovery of universal gravitation is fully appreciated by but few. Gravitation is generally thought of as a mysterious force, acting only between the heavenly bodies, and first discovered by Newton. Had gravitation itself been discovered by Newton as some new principle to account for the motions of the planets, it would not have been so admirable a discovery as that which he actually made. Gravitation in a somewhat limited sphere is known to all men. It is simply the force which causes all heavy bodies to fall or to tend toward the center of the earth.

Every one who had ever seen a stone fall or felt it to be heavy, knew of the existence of gravitation. What Newton did was to show that the motions of the planets were determined by a universal force, of which the force which caused the apple to fall was one of the manifestations, and thus to deprive the celestial motions of all the mystery in which they had formerly been enshrouded. To his predecessors the continuous motion of the planets in circles or ellipses was something so completely unlike any motion seen on the surface of the earth, that they could not imagine it to be governed by the same laws, and, knowing of no law to limit the planetary motions, the idea of the heavenly bodies moving in a manner which set all the laws of terrestrial motion at defiance was to them in no way incredible.

"The idea of a cosmical force emanating from the sun or the earth," says Prof. Newcombe, "and causing the celestial motions, did not originate with Newton. We have seen that even Ptolemy had an idea of a force which, always directed toward the center of the earth, or, which was to him the same thing, toward the center of the universe, not only caused heavy bodies to fall, but bound the whole universe together. Kepler also maintained that the force which moved the planets resided in and emanated from the sun. But neither Ptolemy nor Kepler could give any adequate explanation of the force on the basis of laws seen in action around us; nor was it possible to form any conception of its true nature without a knowledge of the general laws of motion and force, to which neither of these philosophers ever attained."

The great misapprehension which possessed the minds of nearly all mankind till the time of Galileo was, that the continuous action of some force was necessary to keep a moving body in motion. That Kepler himself was fully possessed of this notion is shown by the fact that he conceived a force acting only in the direction of the sun to be insufficient for keeping up the planetary motions and to be required to be supplemented by some force which should constantly push the planet ahead. The latter force, he conceived, might arise from the rotation of the sun on his axis.

"It is hard to see," says Prof. Newcombe, "who was the first clearly to see and announce that this notion was entirely incorrect, and that a body, once set in motion and acted on by no force, would move forwards forever—so gradually did the great truth dawn on the minds of men. It must have been obvious to Leonardo da Vinci, it was implicitly contained in Galileo's law of falling bodies, and in Huyghens's theory of central forces, yet neither of these philosophers seems to have clearly and completely expressed it. We can hardly be far wrong in saying that Newton was the first who clearly laid down this law in connection with the correlated laws which cluster around it. The basis of Newton's discovery were these three laws of motion:

First law: A body once set in motion and acted on by no force, will move forwards in a straight line and with a uniform velocity forever.

Second law: If a moving body be acted on by any force, its deviation from the motion defined in the first law will be in the direction of the force and proportional to it.

Third law: Action and reaction are equal, and in opposite directions; that is, whenever any one body exerts a force on a second one, the latter exerts a similar force on the first, only in the opposite direction.

The first of these laws is the fundamental one. The circumstance which impeded its discovery, and set man astray for many centuries, was that there was no body on the earth's surface acted on by no force, and therefore, no example of a body moving in a continuous straight line. Every body on which an experiment could be made was at least acted on by the gravitation of the earth—that is by its own weight—and, in consequence, soon fell to the earth. Other forces which impeded its motion were friction and the resistance of the air. It needed research of a different kind from what the predecessors of Galileo had given to physical problems to show that, but for these forces, the body would move in a straight line without hindrance."

We are now prepared to understand the very straightforward and simple way in which Newton ascended from what he saw on the earth to the great principle with which his name is associated.

We see that there is a force acting all over the earth, by which all bodies are drawn towards the earth's center. This force extends without sensible diminution not only to the tops of the highest buildings, but of the highest mountains. How much higher does it extend? Why should it not extend to the moon? If it does the moon would tend to drop to the earth just as a stone thrown from the hand does. Such being the case, why should not this simple force of gravity be the force which keeps the moon in her orbit, and prevents her from flying off in a straight line under the first law of motion?

To answer this question, it was necessary to calculate what force was requisite to retain the moon in her orbit, and to compare it with gravity. It was at that time well known to astronomers that this distance of the moon was sixty semi-diameters of the earth. Newton at first supposed the earth to be less than 7,000 miles in diameter, and consequently his calculations failed to lead him to the right result. This was in 1665, when he was only twenty-three years of age. He laid aside his calculations for nearly twenty years, when, learning that the measures of Picard, in France, showed the earth to be one-sixth larger than he had supposed, he again took up the subject. He now found that the deflection of the orbit of the moon from a straight line was such as to amount to a fall of sixteen feet in one minute the same distance which a body falls at the surface of the earth in one second. "The distance fallen," says Professor Newcombe, "being as the square of the time it followed that the force of gravity at the surface of the earth was 3,600 times as great as the force which held the moon in her orbit. This number was the square of 60, which expresses the number of times the moon is more distant than we are from the center of the earth. Hence the force which holds the moon in her orbit is the same as that which makes a stone fall, only diminished in the inverse square of the distance from the center of the earth."

Kinematic Susceptibility.

Verily, this is a mathematical age. The day is not far distant, we are told, when there will be no wars, neither rumors of wars; for the two opposing generals—rather let us say mathematicians—may sit down at the

same table, and being provided with accurate data of the forces each could bring into the field, together with the number and caliber of guns, the fighting possibilities of their men, and the money at hand, may readily be enabled to compute the result, and hand over the loot beforehand.

So, in looking over a recent mathematical work by a learned mathematician, and finding a note on a class of transformations which surfaces may undergo in space of more than three dimensions, we cannot help but think how readily the formula might be turned into use to solve questions of a purely ethical complexion, or, indeed, to interpret the most ordinary affairs of life.

The learned professor says: "If the material bodies which surround us were placed in a space of more than three dimensions, their kinetic susceptibilities would be increased in a manner which, at first sight, would seem very extraordinary. Each body would, in fact, be susceptible of n independent motions, and $\frac{n\ (n-1)}{2}$ separate rotations, n being the number of dimensions of the space."

He says his present purpose is not, however, to discuss the general theory of the subject, but to point out a special case of it, as seen in a remarkable transformation to which closed surfaces may be subjected in space of four dimensions. The proposition in question may, he says, be expressed as follows:

"If a fourth dimension were added to space, a closed material surface (or shell) could be turned inside out by simple flexure, without either stretching or tearing. For simplicity, we may suppose the surface to be spherical. Let

$$x, y, z, u,$$

be the general rectangular co-ordinates in the suppo-ed space of four dimensions. An infinite plane space of three dimensions may then be represented by the equation:

$$ax + by + cz + du = A,$$

a, b, etc., being any constants whatever. For simplicity, we may suppose a, b and c all equal to zero, and the axes of x, y and z, therefore, to lie in the space of three dimensions under consideration. A Euclidian or natural space may then be represented by the single equation, $u = A$, A being an arbitrary constant. The four-dimensional space may be divided into an infinity of Euclidian spaces by giving all possible values to A." And so on.

That's as good as a fairy tale! Of course, no one who reads it will doubt that the Euclidian marries A, and they begin housekeeping down among the secluded shades of that charming region watered by the Gowanus canal. The other fellow, as will be seen by the equation, evidently had "kinematic susceptibility," and was sent to the asylum; but the mystery remains, *what became of the old man?*

To What is the Lack of Purely Scientific Work in America Attributable?

England has her Jingoism, France her Chauvanism, Germany her *Windbeutelei*, and America her Spread-eagleism; but when each comes to make a self examination, that is sure to be found which is sadly in want of correction—that should be apologized for rather than boasted of.

Mr. Matthew Arnold, who possesses as much critical ability as any of his kind, and more egotism than any man of them, told us during his recent apostolic mission to this country in behalf of "loveliness and light," that our greatest defect was Philistinism. His countryman, Sir Leppel Griffin, who has all his boorishness and ego ism, without any of his brains, tells the small world covered by that stagnant pool of platitude, the *Quarterly Review*, that the Americans go in for quantity and not quality.

Though it's a serious question whether Philistinism is not to be preferred to the egotism and boorishness of the former, and quantity to the pig-headed ignorance of the latter, we all admit that both were partly right.

But though it was as clear as daylight, both failed to observe what is at least one of our chiefest defects or misfortunes, and eagerly pursued pigmy failings, while giant faults strode openly around about them. Little men, each in his way, they were after the infinitesimal, and hugged themselves with delight and loudly proclaimed their success when they had found it.

Had they examined some of our five hundred alleged universities and colleges, they would have discovered that all but two of the former were little better than second-rate colleges, and most of the latter did not rise above the grade of high schools.

That education is more generally diffused here in America than in Europe, is so well known that, when addressing an intelligent audience, no corroborative proof is required, and it will not be denied there is reason to believe, save by those insular persons, who, like Matthew Arnold and his fellows, are wont to reverse the order of things, by describing a country first and seeing it afterward.

But the higher education is by no means up to the European standard, and had these, our censors, looked deep enough, they had discovered that this was the primal cause of the effect which they so congratulated themselves upon discovering.

Materialism and practicality are good in their way, and this being a practical age they are wanted, but the spring from which they proceed primarily should not be allowed to run dry.

Fifty millions of dollars are annually expended in this country in support of the five hundred alleged universities and colleges, and yet there is not an established seat of learning in the country where the closet student may be supplied with the means for original investigation, and that support by which the mind may be permitted to wander from the contemplation of daily wants.

The American public is interested and amused by the discoveries of scientific men, but astonished whenever a proposal is made to assign a salary or pension to a few such persons sufficient to enable them to support their families while devoting their time and strength to original investigation.

We enjoy the benefits that are continually being derived from applied science, and give all the credit to those who are making fortunes by reason of the industry and studiousness of great men who died in comparative poverty.

We compare the advantages of the various systems of electric lighting, and congratulate ourselves upon the acuteness of our own generation in producing them, forgetting, meanwhile, that each and every one of them is based upon principles discovered by a Faraday, whose only reward was that he had contributed to the world's knowledge.

The endowment of research by the State, or from public funds of any kind, is opposed on various grounds. One is that such action on the part of the Government is well enough in Europe, but is contrary to the spirit of popular government which leaves scientific as well as other enterprise to the individual initiative of the people. This objection is based on error, both as to fact and theory. It is well enough to leave to individual effort the conduct of such enterprises as are remunerative to the parties who conduct them; but it is a mistake to speak of scientific research as an "enterprise" at all. The mistake arises from the extraordinary pertinacity with which so-called "invention" is confounded with the discovery of scientific truth. New knowledge in any branch of science cannot be sold; it has no marketable value. Koch could not have sold the discovery of the bacterium of phthisis for as much as a dollar, had he wished to do so. Accordingly, we find there is not, and never has been, any tendency among the citizens of this country to provide for themselves institutions for the manufacture of an article of so little pecuniary value to the individual who turns it out as is new knowledge.

We are called upon to emphatically distinguish the two functions, viz., that of creating new knowledge, and that of distributing existing knowledge; and to maintain that it is only by arbitrary and undesirable arrangements not likely to be tolerated or, at any rate, extended at the present day, that the latter can be made to serve as the support of the former. We agree most cordially with those who hold that it is an excellent thing for a man who is engaged in the one to give a certain amount of time to the other. It is a matter of experience that the best teachers of a subject are, *ceteris paribus*, those who are actually engaged in the advancement of that subject, and who have shown such a thorough understanding of that subject as is necessary for making new knowledge in connection with it. It is also in most cases a good thing for the man engaged in research to have a certain small amount of change of occupation, and to be called upon to take such a survey of the subject in connection with which his researches are made as is involved in the delivery of a course of lectures and other details of teaching.

A third objection which is sometimes made to the proposition that scientific research must be supported and paid for as such, is the following: It is believed by many persons that a man who occupies his best energies in scientific research can always, if he choose, make an income by writing popular books or newspaper articles in his spare hours; and, accordingly, it is gravely maintained that there is no need to provide stipends and the means of carrying on their work for researchers. To do so, according to this view, would be to encourage them in an exclusive reticence, and to remove from them the inducement to address the public on the subject of their researches, by which the public would lose valuable instruction. They mock at the botanist as a pedant, and the zoologist as a monomaniac; they execrate the physiologist as a monster of cruelty, and brand the geologist as a blasphemer: chemistry is held responsible for the abomination of analine dyes and the pollution of rivers, and physics for the dirt and misery of great factory towns. By these unbelievers, science is declared responsible for individual eccentricities of character as well as for the sins of the commercial ulilizers of new knowledge. The pursuit of science is said to produce a dearth of imagination, incapability of enjoying the beauty either of nature or of art, scorn of literary culture, arrogance, irreverence, vanity, and the ambition of personal glorification.

Such are the charges from time to time made by those who dislike science; and for such reasons they would withhold, and persuade others to withhold, the fair measure of support for scientific research which this country owes to the community of civilized States. Not in reply to these misrepresentations, but by way of contrast, we might here state what science seems to be to those who are on the other side, and how, therefore, it seems to them wrong to delay in doing all that the wealth and power of the State can do to promote its progress.

"Science," says Prof. Lankester, "is not a name applicable to any one branch of knowledge, but includes all knowledge which is of a certain order or scale of completeness. All knowledge which is deep enough to touch the causes of things is science: all inquiry into the causes of things is scientific inquiry. It is not only co-extensive with the area of human knowledge, but no branch of it can advance far without reacting upon other branches: no department of science can be neglected without sooner or later causing a check to other departments. No man can truly say this branch of science is useful and shall be cultivated, whilst this is worthless and shall be let alone: for all are necessary; and one grows by the aid of another, and in turn furnishes methods and results assisting in the progress of that from which it lately borrowed.

"We desire the increase and the support and the acceptance of science, not only because it has a certain material value and enables men to battle with the forces of nature, and to turn them to account so as to increase both the intensity and the extension of healthy human life; that is a good reason, and for some persons it may be the only reason. But there is something to be said beyond this.

"The pursuit of scientific discovery, the making of new knowledge, gratifies an appetite, which, from whatever cause it may arise, is deeply seated in man's nature, and, indeed, is the most distinctive of his properties. Man owes his intense desire to know the nature of things, smothered though it often be by other cravings which he shares with the brutes, to an inherited race-perception, stronger than the reasoning faculty of the individual. When once aroused, and in a measure gratified, the desire becomes a guiding passion. The instinctive tendency to search out the causes of things, gradually strengthening as generation after generation of men have stumbled and struggled in ignorance, has at last become an active and widely extending force; it has given rise to a new faith."

We know that we possess, here in America, fine material for closet studies; many men of unusual talent would gladly devote themselves to the contemplation and exploration of purely scientific themes. But they are very naturally disinclined to do this unless they can see a way by which their families may in the meantime be supplied with the comforts of life.

If, instead of nearly five hundred alleged universities and colleges in this country, many of which are arrant shams, we had four or five great seats of learning, and the fifty millions per year now paid to support this thin layer of mediocrity were used to richly endow five centers of education, then we might look forward to seeing worthy investigators supplied not only with every apparatus and book necessary to original investigation, but also with a liberal income, which should place them and theirs above those crying necessaries of life, without which it is manifestly illogical to expect any man to labor.

Detecting Scientific Frauds.

It is by no means surprising that a large class of practical people, too much engrossed in the ordinary and every-day affairs of life to consider the relative merits of that which they hear, should be inclined to doubt the advantages of advanced chemistry; for, on every hand, they see this noble science prostituted for money-getting. Before the art was practiced, the people were supplied with pure, if not refined, food. Now, all this is changed. Coffee, tea, sugar beer, butter, and almost every one of the necessaries of life are counterfeited by the aid of chemistry; and if it be asserted that, without chemistry, we would not be able to return a substance to its constituent parts, the answer might, not unreasonably, be returned that if there was no chemistry there would not be required any analysis.

Recent investigations in New York City have shown that nearly everything in the way of food is adulterated more or less; and there are those sanguine persons who believe that, in this case, the disease brings with it its own antidote, for that the work of disreputable chemists can never be sure or lasting so long as there are able and reputable chemists to detect and expose it.

That we have this relief at hand, and that it is possible to make it efficient, there is, judging from at least a single gratifying instance, but little doubt.

Five years ago it was next to impossible to obtain pure milk in the City of New York. At the Thirty-third Street milk station, where the in-coming milk cars were switched off, the milkmen watered their milk in public, and receipted for their skim milk. Through the exertions of a single analysist, Dr. John Blake White, backed up by the Board of Health, the nefarious traffic was struck a stunning blow, and later on, others assisting him, he was enabled by means of the courts to altogether destroy the trade in impure milk. Despite the clamor of presuming ignorance, Dr. White pushed on his labors amid difficulties that it would be useless to recount, since all have been overcome. His ingenuity devised the means of checkmating the most determined moves of the swill milkmen, backed as they were by money and influence, and his ability as a physician and skill as an analysist thwarted the endeavors made by designing chemists to sustain the pretensions of the milk swindlers.

This leads us to believe that all the unlawful—indeed, criminal—schemes to adulterate the public food can be unearthed and exposed by much the same means as that adopted by Dr. Blake White.

Against Telegraph Monopoly.

Judge Baxter, of the United States Circuit Court, at Cleveland, Ohio, has issued a supplementary order in the suit of the National Telegraph Company against the New York, Chicago and St. Louis Railway Company respecting the telegraph line along the Nickel Plate Railroad. The railway company has heretofore refused to transport the telegraph material of the National Telegraph Company and perform other obligations made under contract. The first order of Judge Baxter simply restrained the railroad company from interfering with the telegraph company in its possession and use of the line. The supplemental order preserves the rights of the parties as defined by the contract between them, and further orders that the railway company concede to the telegraph company the right and privilege therein stipulated for. The supplemental order is full and complete, leaving the course of the telegraph company clear and its claims fully recognized.

The Western Union Telegraph Company has carried into effect its avowed intention of capitalizing the cost of constructing its pneumatic tube and the new building in Twenty-third and Broad streets by issuing the remaining $1,000,000 of the $6,000,000 of 7 per cent. bonds which were authorized Oct. 14, 1874. This issue was made last month, and the entire $1,000,000 was sold to the Euvitable Life Assurance Society. The price paid for these bonds is stated to have been 113.

Supt. Barrett, of the City Fire Alarm Telegraph of Chicago, has arranged to put fifty miles of the fire alarm wires under ground. An ordinary sewer pipe will be utilized as a conduit, and the insulating material will be Kerite, such as manufactured by A. G. Day, of Seymour, Conn.

Calling Him Up.

He didn't appear to be a bank cashier or a newspaper editor, as he strolled into an Alabama street grocery in Atlanta.

He was simply a six-foot Clayton county lad, and was looking for the State road depot.

"Do ye know whether the agint is there or not?" he queried, after being directed to the right place.

"I don't," answered the proprietor impatiently. "You can call him through the telephone and find out," waving his hand toward that instrument.

The countryman looked first at the telephone and then at the merchant. At last he blundered out:

"Mister, I reckon I looks purty green, but lemme tell you, I knows when a feller's tryin' to make fun of me, and I won't stand it."

"What do you mean?" asked the merchant.

"How'n blazes air that agint agoin' to git through that little hole!" exclaimed the Claytonite.

Smiling softly, the merchant arose, transmitted the man's message, and received a satisfactory reply.

For a moment the countryman looked blank, and then seizing the groceryman's hand, he said:

"Mister, I'm an idiot; fergive me fer my rough words; an," here he paused, looked thoughtful for a moment, and continued: "An' tell me how you got that agint penned up in such a little box?"

Any of our readers having copies of the old REVIEW of the TELEGRAPH AND TELEPHONE, dated March 15th, 1882 (No. 3), not specially needed by them, will confer a great favor upon us by sending them to this office, for which we will remit twenty-five cents per copy. DELANO & COMPANY,
23 Park Row, New York.

Box 3,329.

Messrs. Holmes, Booth & Haydens, after a residence at their old stand, 49 Chambers Street, of twenty-two years, will remove to the large store at 25 Park Place and 22 Murray Street, on May 1st.

The Harden hand grenade achieved an immediate and great triumph on its trial at the City Hall last month. Masses of material of the most inflammable character were apparently inextinguishably fired, but on the instant the grenades were cast upon them the flames were totally extinguished. The Harden hand grenade fire extinguisher consists of a small and easily-handled glass globe, filled with a chemical fluid, highly saturated with and generating in fire-heat an immense volume of fire-extinguishing gas, in which it is impossible for combustion to continue. The fluid itself is perfectly harmless to person or clothing. The grenades are not intended to supply the place of a fire department, but simply to enable everybody to conquer incipient fires before a fire-engine could reach them. For buildings of every character it would appear that their value as extinguishers is exceptional.

New York and Boston are connected by telephone wires that "convey the faintest whisper." Faintest whispers are good in their way, but a wire that will telephone baked beans from Faneuil Hall to Broadway will rake in dividends that will make the stockholders' heads swim.—*G. L. B, Old Guard.*

A messenger boy was caught running wildly through Broadway. He stopped just long enough to explain that it was an April fool joke, and that he would never hurry again.—*Major D., Old Guard.*

Messrs. R. W. Pope & Company, electrical engineers and dealers in electrical supplies in Baltimore, Md., have recently moved into their new building and enlarged quarters, their trade having increased beyond the capacity of their old place. Mr. Pope is an excellent electrician, and widely known in the electrical field. His enterprise will win him a successful business anywhere.

TRENTON, N. J., March 29, 1884.

Editor Electrical Review:

Can you tell us who makes a good individual Call Bell for telephone lines, and which one, in your opinion, is the best now in use,

Yours truly, C. & B. Co.

ANSWER.

The Cary Individual Call, manufactured by the Cary Telephone Signal Company, of Boston, is a good one, and the Bliss Call Bell, of Lowell. These are the only ones now being used to our knowledge to any extent. I believe both are giving satisfaction.—ED.

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Average Market Quotations of Battery Supplies for the Week Ending April 10th, 1884.

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" Prisms, per pair	$1.00
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" Jar Cover	12c
" Sal Ammoniac, in bag	8c.
" Porous Cell	$1.10
" Glass Jar	18c.
" Amalgamated Zinc	10c.
" Rubber Bands, per pair	6c.
Chlorine Battery, per cell	$1.25
Law Battery, per cell	$1.25
" Jar and its Rubber Ring	25c.
" Cover, with small Carbon sealed in	35c.
" Large Carbons, each	20c.
" Carbon Connector	12c.
" Zinc Connector	8c.
" Rubber Bolt	12c.
" Zinc and its Rubber Ring	12c.
Bergman & Haid, per cell	$1.20
Crow foot, 6x8, per cell	75c.
Callaud Zincs	30c.
" Coppers	15c.
" Jars	25c.
Sal Ammoniac, per lb	15c.
Blue vitriol, per lb	10c.
" " bbl., lots, per lb	5½c
Sulphate of zinc	10c.
Battery syringe	$1.90c.
Battery brush	20c.
Hydrometer	50c.

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ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING APRIL 8, 1884.

296,319 Electro-magnetic brake system; Augustus L. Duwelius, Cincinnati, O.

296,331 Portable electric battery and lamp; Chas. Godfrey Gumpel, Leicester Square, County of Middlesex, England.

296,341 Electrical igniting device for gas engines; Hiram S. Maxim, Brooklyn, N. Y.

296,349 Electro-magnetic car-brake; Harvey S. Park, Henderson, Ky.

296,365 Galvanic battery; Henry Thame, Winders Road, High street, Battersea, County of Surrey, England.

296,380 Electric helix and method of winding the same; Foree Bain, Minneapolis, Minn., assignor to the Bain Electric Company, Chicago, Ill.

296,401 Machine for carding buttons by means of electricity; Louis Gillou, Les Lilas, near Paris, France.

296,407 Lightning arrester for telegraph and telephone lines; John Griffin, Philadelphia, Pa.

296,420 Receiving telephone; James A. Maloney, Washington, D. C.

296,421 Telephone transmitter; Jas. A. Maloney, Washington, D. C.

296,464 Voltaic pile; August Schroeder, Stettin, Germany.

296,485 Means for supporting and insulating electrical wires; John Watson, Tringham, Windsor, Ontario, Canada.

296,546 Electro-magnetic air-brake; Henry Flad, St. Louis, Mo.

296,547 Electrical connector in pipe couplings for air-brakes; Henry Flad, St. Louis, Mo.

296,549 Electro-magnetic valve and connection; Henry Flad, St. Louis, Mo.

296,569 Dynamo-electric machine; Edwin J. Houston and Elihu Thomson, Philadelphia, Pa., assignors to the Thomson-Houston Electric Company.

296,588 Individual signalling apparatus; Thomas D. Lockwood, Malden, Mass.

296,593 Electric telephone transmitter; James A. Maloney, Washington, D. C.

296,641 Morse register and perforator; Lorin C. Springer, Hyde Park, assignor of eleven-twelfths to Chancy G. Wright, Chicago, Ill.

296,653 Apparatus for distributing time-signals over lines employed for other purposes; Frank Waldo, Washington, D. C., assignor of one-half to Leonard Waldo, New Haven, Conn.

296,676 Telephone transmitter; Sager Chadwick, Philadelphia, Pa., assignor of one-half to E. V. Machette, same place.

296,688 Insulating support for electric conductors David S. Haines, New York, and Stephen D. Lake, Brooklyn N. Y.

A printed copy of the specification and drawing of any patent to the annexed list, also of any patent issued since 1865, will be furnished by any of the patent solicitors whose advertisements appear in this journal. In ordering please state the number and date of the patent desired.

ELECTRICAL AND MECHANICAL ENGINEER, very experienced in designing dynamos and lamps, &c., &c., wants position as electrician, with already established or now forming company. Address "Electrician," P. O. box 88, Greenpoint, L. I.

Notice.

The new (1884) edition, "Berly's Universal Electrical Directory," now ready for delivery, price $3, has been thoroughly revised, greatly enlarged, and many new features added to enhance its value. Send for descriptive circular and table of contents. Cumming & Brinkerhoff, 219 East Eighteenth Street, New York City.

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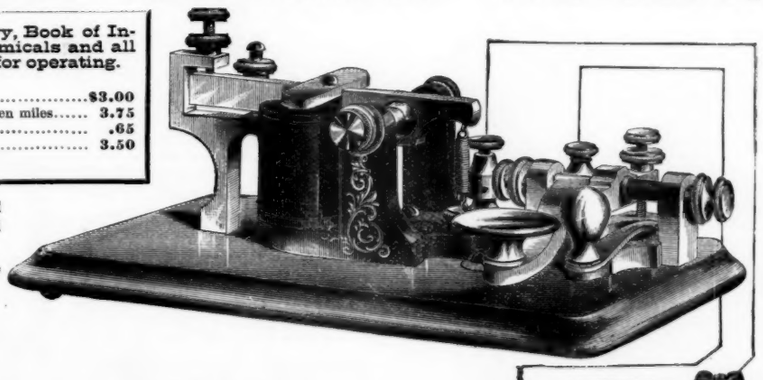

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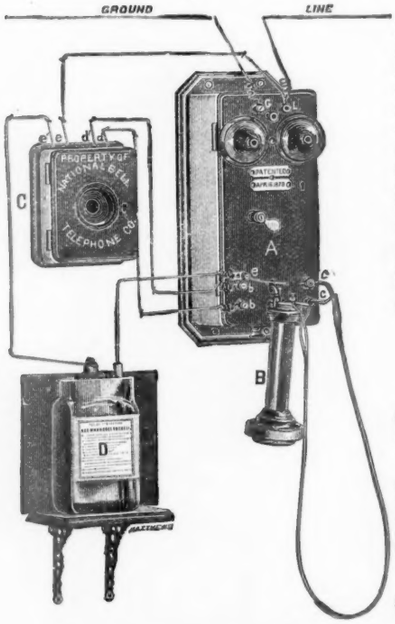

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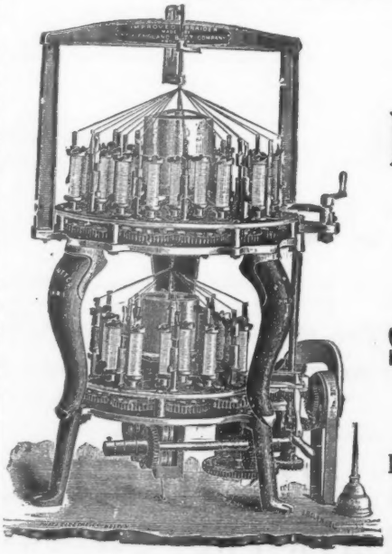

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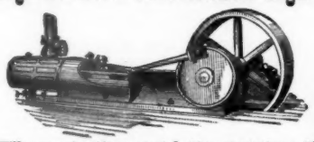

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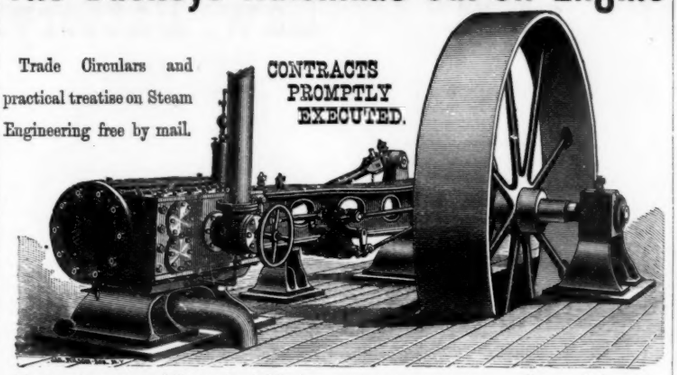

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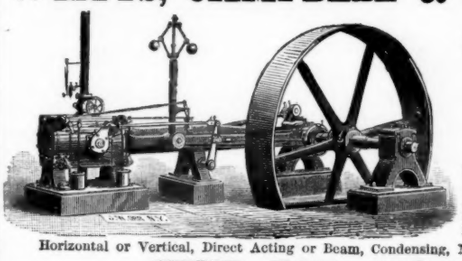

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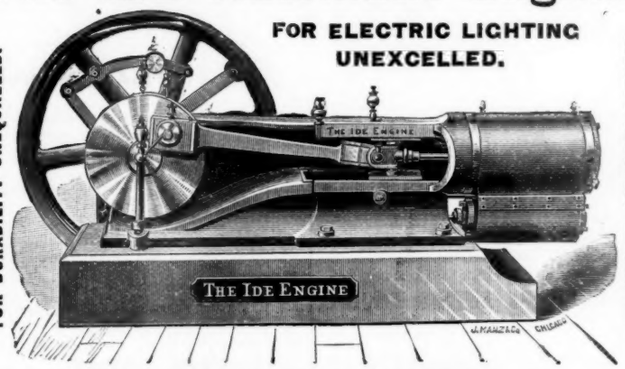

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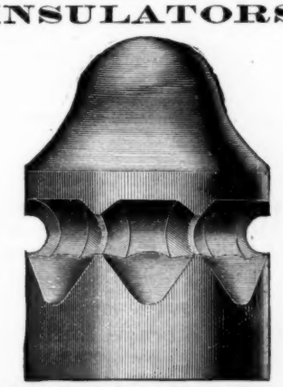

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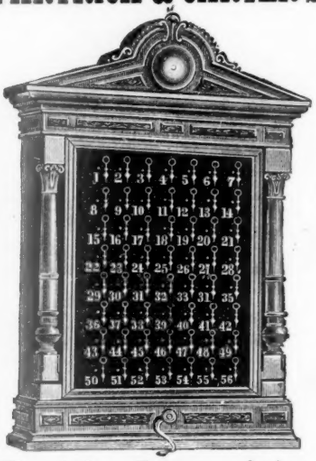

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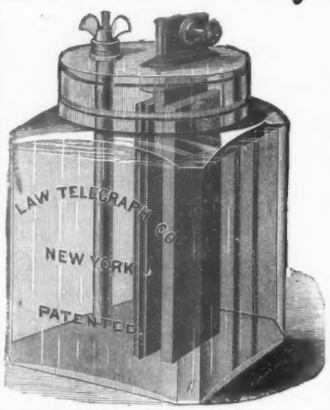

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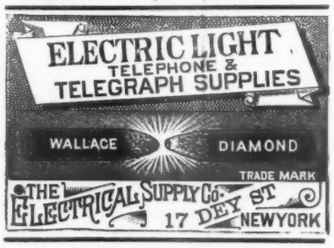

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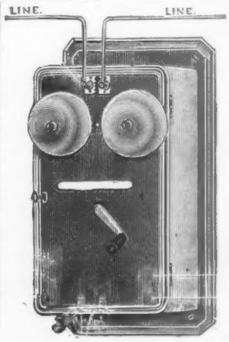

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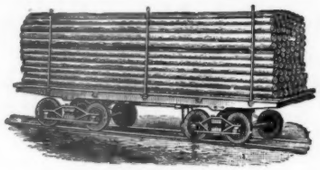

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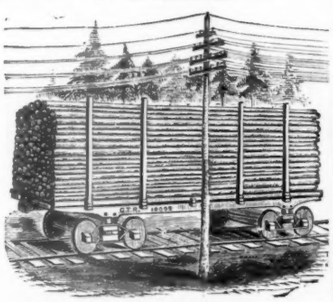

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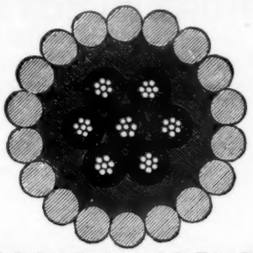

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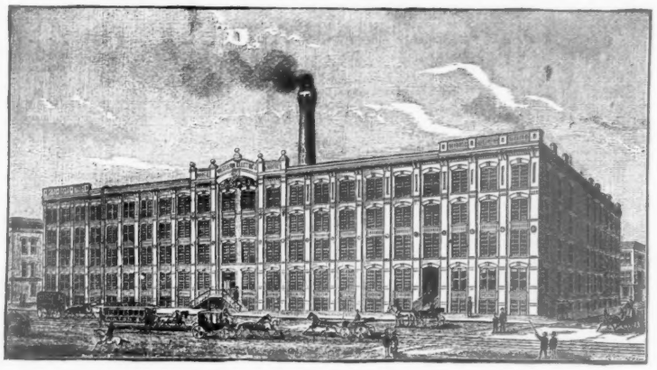

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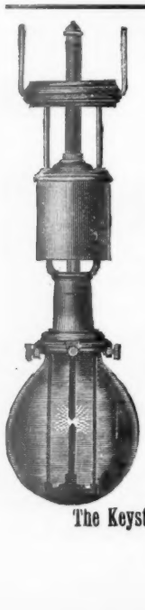

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